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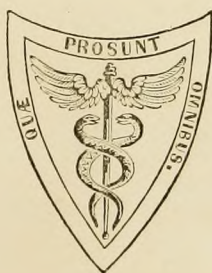
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A TREATISE
ON THE
DISEASES
OF
INFANCY AND CHILDHOOD.

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P R E F A C E.

THE purpose of the author has been to present a description of the diseases of infancy and childhood succinctly, but at the same time in a sufficiently comprehensive manner to meet the requirements of the medical student and practitioner. He has endeavored to incorporate in the treatise all recently ascertained facts relating to this branch of medical practice, and especially has it been his endeavor to recommend such modes of treatment as comport with and are suggested by our present knowledge of the pathology of early life, the efficacy of hygienic measures in the treatment of the young, and the recuperative powers of the system at this age.

While the author has respected the opinions of previous writers, and has adopted them, so far as they appeared to be correct, he has depended much more for the material of his treatise on clinical observations and the inspection of the cadaver. Necessarily, as a result of independent investigations, opinions are now and then expressed different from those which are commonly accepted. Novel views have not, however, been presented, unless the author was fully satisfied that they were substantiated by a sufficient number of observations.

227 WEST 49TH STREET, NEW YORK.

January, 1869.

CONTENTS.

PART I.

CHAPTER I.

INFANCY AND CHILDHOOD	Page 17
---------------------------------	---------

CHAPTER II.

CARE OF THE MOTHER DURING PREGNANCY	19
---	----

CHAPTER III.

MORTALITY OF EARLY LIFE—ITS CAUSES AND PREVENTION	21
---	----

CHAPTER IV.

LACTATION	25
Hindrances to Lactation, and Physical Conditions rendering it Improper—Facts and Notes in reference to Lactation—Human Milk—Modification of the Milk in consequence of the Diet—Modifications in the Milk from its Retention in the Breast—Modification of the Milk by Age and Nervous Impressions—Modification of the Milk by the Catamenial Function, and Pregnancy—Quantity of Breast Milk required by the Infant—Differences in Suckling Women as regards Quantity and Quality of Milk—Scarciness of Milk; its Causes and Treatment.	

CHAPTER V.

SELECTION OF A WET-NURSE	31
------------------------------------	----

CHAPTER VI.

COURSE OF LACTATION—WEANING	35
---------------------------------------	----

CHAPTER VII.

ARTIFICIAL FEEDING	38
------------------------------	----

CHAPTER VIII.

DIAGNOSIS OF INFANTILE DISEASES	61
General Observations—Features, External Appearance of Head, Trunk, and Limbs in Disease—Attitude—Movements—The Cry—Respiratory System—Respiration in Health—Respiration in Disease—Circulatory System—Pulse in Health—Pulse in Disease—Animal Heat—Digestive System.	

PART II.

SECTION I.

DISEASES OF THE CEREBRO-SPINAL SYSTEM.

CHAPTER I.

ANENCEPHALUS—ANENCEPHALUS	PAGE
Anatomical Characters—Symptoms—Prognosis.	77

CHAPTER II.

IMPERFECT BRAIN	PAGE
A Case—Symptoms—Prognosis—Microcephalus—Atrophy of Brain.	79

CHAPTER III.

HYDROCEPHALUS OF BRAIN	PAGE
Pathological Anatomy—Causes—Cerebrum—Symptoms—Diagnosis—Prognosis—Treatment.	81

CHAPTER IV.

TUMORS OF THE CEREBRAL SYSTEM	PAGE
Anatomical Characters—Causes—From Ovary—Symptoms—Diagnosis—Prognosis—Treatment.	85

CHAPTER V.

CONGESTION OF BRAIN	PAGE
Active and Passive—Causes—Symptoms—Anatomical Characters—Prognosis—Treatment.	91

CHAPTER VI.

INTRACRANIAL HEMORRHAGE (MEDULLARY HEMORRHAGE—CEREBRAL HEMORRHAGE)	PAGE
Causes—Anatomical Characters—Symptoms—Diagnosis—Prognosis—Treatment.	95

CHAPTER VII.

CHRONIC HYDROCEPHALUS	PAGE
Anatomical Characters—Symptoms—A Case—Diagnosis—Prognosis—Treatment.	111

CHAPTER VIII.

ACQUIRED HYDROCEPHALUS	PAGE
Causes—Anatomical Characters—Location and Quantity of Fluid—Symptoms—Prognosis—Treatment.	129

CHAPTER IX.

MENINGITIS, SIMPLE AND TUBERCULAR	PAGE
Age—Anatomical Characters—Causes—Progressive Stage—Symptoms—Diagnosis—Prognosis—Treatment.	125

CHAPTER X.

SPURIOUS HYDROTHORAX	PAGE 147
Anatomical Characters—Cases—Symptoms—Diagnosis—Prognosis—Treatment.	

CHAPTER XI.

ECLAMPSIA	154
Essential, Symptomatic, Sympathetic, General, and Partial—Cases—Prenatal Stage—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment.	

CHAPTER XII.

TETANUS NASCENTIUM	168
Period of Commencement—Frequency in Certain Localities—Causes—Symptoms—Mode of Death—Duration in Fatal Cases—Duration in Favorable Cases—Diagnosis—Preventive Treatment—Treatment.	

CHAPTER XIII.

INTERNAL CONVULSIONS	172
Different Forms—Causes—Anatomical Characters—Symptoms—Diagnosis—Prognosis—Modes of Death—Treatment.	

SECTION II.

DISEASES OF THE RESPIRATORY SYSTEM.

CHAPTER I.

CORYZA	184
Causes—Anatomical Characters—Symptoms—Prognosis—Treatment.	

CHAPTER II.

SIMPLE LARYNGITIS; SPASMODIC LARYNGITIS	197
Simple Laryngitis: Symptoms—Anatomical Characters—Treatment. Spasmodic Laryngitis: Causes—Symptoms—Anatomical Character—Pathology—Diagnosis—Prognosis—Treatment.	

CHAPTER III.

PURULE-HEMORRHOIDIC LARYNGITIS	217
Causes—Anatomical Characters—Symptoms—Diagnosis—Prognosis—Treatment—Traditionary.	

CHAPTER IV.

BRONCHITIS	235
Causes—Anatomical Characters—Symptoms—Capillary Bronchitis—Diagnosis—Prognosis—Treatment.	

CHAPTER V.

	PAGE
PNEUMONITIS	228
Lobar and Lobular—Causes—Hypostasis—Anatomical Characters—Symptoms—Physical Signs—Diagnosis—Prognosis—Treatment.	

CHAPTER VI.

PLEURITIS	237
Causes—Anatomical Characters—Etiology—Symptoms—Physical Signs—Diagnosis—Treatment—Differential Diagnosis.	

SECTION III.

DISEASES OF THE DIGESTIVE APPARATUS.

CHAPTER I.

SIMPLE STOMATITIS; ULCEROSE STOMATITIS; FOLLICULAR STOMATITIS	250
<i>Simple or Erythematous Stomatitis</i> ; Causes—Symptoms—Appearance—Treatment. <i>Ulcerous Stomatitis</i> ; Anatomical Characters—Causes—Symptoms—Diagnosis—Prognosis—Treatment. <i>Follicular Stomatitis</i> ; Anatomical Characters—Causes—Symptoms—Diagnosis—Prognosis—Treatment.	

CHAPTER II.

THROAT	261
Anatomical Characters—Description of the Oidium Alabastrum—Symptoms—Causes—Diagnosis—Prognosis—Treatment.	

CHAPTER III.

GARGLETS OF THE MOUTH	267
Anatomical Characters—Age—Causes—Symptoms—Diagnosis—Prognosis—Treatment.	

CHAPTER IV.

DENTITION	272
Pathological Results of Dentition—Diagnosis—Treatment—Scarification of the Gums—Second Dentition.	

CHAPTER V.

SIMPLE PHARYNGITIS; RETRO-PHARYNGEAL ABSCESS; OESOPHAGITIS	314
<i>Pharyngitis</i> ; Anatomical Characters—Causes—Symptoms—Prognosis—Diagnosis—Treatment. <i>Retro-Pharyngeal Abscess</i> ; Age—Cause—Anatomical Characters—Symptoms—Duration—Diagnosis—Prognosis—Treatment. <i>Oesophagitis</i> ; Anatomical Characters—Treatment.	

CHAPTER VI.

	PAGE
INFLAMMATION; CONGESTION OF STOMACH; GASTRITIS; FOLLICULAR GASTRITIS; DYSPEPSIA; GASTRITIS; POST-MORTEM DYSPEPSIA; SOFTENING	377
<i>Indigestion: Causes—Symptoms—Prognosis—Treatment. Congestion of the Stomach. Gastritis: Causes—Age—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment. Follicular Gastritis; Diffuse Gastritis; Post-Mortem Digestion; Gastritis Softening, White Softening.</i>	

CHAPTER VII.

DIARRHOEA	387
<i>Non-Inflammatory Diarrhoea: Causes—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment.</i>	

CHAPTER VIII.

INTESTINAL INFLAMMATION OF INFANCY	395
<i>Causes—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment—Regimental Measures—Medicinal Treatment—Enemas—External Treatment.</i>	

CHAPTER IX.

ENTERITIS AND COLIC IN CHILDHOOD	398
<i>Causes—Symptoms—Diagnosis—Prognosis—Treatment.</i>	

CHAPTER X.

CHOLERA INFANTUM	400
<i>Definition of the Term—Its Prevalence in the Cities—Causes—Symptoms—Anatomical Characters—Diagnosis—Prognosis—Treatment.</i>	

CHAPTER XI.

INTESTINAL WORMS	408
<i>Five Kinds—Description of them—Causes—Symptoms—Diagnosis—Prognosis—Treatment—Use of Scabiosa, Spigelia, Chamaedorea.</i>	

CHAPTER XII.

GASTRO-INTESTINAL HÆMORRHAGE	412
<i>Three Varieties—Causes—Prognosis—Treatment.</i>	

CHAPTER XIII.

INTUSSUSCEPTION	418
<i>Simple Intussusception—Intussusception with Symptoms—Previous Health—Causes—Seat and Pathological Anatomy—Intussusception in the Small Intestine—Intussusception in Large Intestine—Symptoms—Diagnosis—Duration—Prognosis—Mode of Death—Treatment.</i>	

SECTION IV. ZYMOTIC DISEASES.

CHAPTER I.

DIPHTHERIA	PAGE 422
Anatomical Characters—Symptoms—Nature—Severity—Anemia— Paralysis—Diagnosis—Prognosis—Treatment.	

CHAPTER II.

MEASLES	PAGE 440
Symptoms—Complications: Capillary Bronchitis, Pneumonia, Typh Croup, Diphtheria—Anatomical Characters—Nature—Diagnosis— Prognosis—Treatment.	

CHAPTER III.

SCARLET FEVER	PAGE 471
Symptoms—Regular Form—Irregular Form—Malignant Form— Complications: Gangrene of Mouth, Articular Rheumatism, Serous Inflammation—Scarlet—Nephritis, Otitis—Anatomical Char- acters—Nature—Diagnosis—Prognosis.	

CHAPTER IV.

TREATMENT OF SCARLET FEVER	PAGE 492
----------------------------	-------------

CHAPTER V.

VARIOLA—VARICELLOID	PAGE 507
Incubative Period—Stage of Invasion—Stage of Eruption—Stage of Desiccation—Desquamation—Variola—Mode of Death—Ana- tomical Characters—Complications—Prognosis—Diagnosis—Treat- ment.	

CHAPTER VI.

VACCINA	PAGE 519
History of Vaccination—Appearance, Symptoms, Anomalies, Complications, and Sequelæ—Subsequent Vaccination—Protective Power of Vaccination—Revaccination—Selection of Virus.	

CHAPTER VII.

VARIELLA	PAGE 528
Incubative Period—Distinguished from Variola—Symptoms—Diag- nosis—Prognosis.	

CHAPTER VIII.

PERTUSSIS	PAGE 531
Symptoms—Complications—Convulsions—Bronchitis—Pneumonia —Thrombosis—Diagnosis—Prognosis—Treatment.	

CHAPTER IX.

PAROTITIS	PAGE
Naturo-Diagnosis.	343

CHAPTER X.

SYPHILIS	347
Etiology—Clinical History—Syphilitic Manifestations—Coryza—Mucous Patches—Rosola—Pompholyx—Acan, Impetigo, and Ecthyma—Visceral Lesions—Prognosis—Treatment.	

SECTION V.

DISEASES OF THE SKIN.

CHAPTER I.

ERYTHEMA; ROSOLEA	355
<i>Erythema Papula; Erythema Intertrigo</i> : Diagnosis—Prognosis—Treatment. <i>Rosola</i> : Diagnosis—Causes—Prognosis—Treatment.	

CHAPTER II.

ERYSIPELAS; ECZEMA; SCABIES	368
<i>Erysipelas</i> : Age—Point of Coarctation—Causes—Transitory Symptoms—Symptoms—Prognosis—Duration—Modes of Death—Pathological Anatomy—Treatment. <i>Ecze-ma</i> : Symptoms—Diagnosis—Treatment. <i>Scabies</i> : Diagnosis—Treatment.	

SECTION VI.

DISEASES OF THE CIRCULATORY SYSTEM.

CHAPTER I.

CYANOSIS	378
Definition of Cyanosis—Sex—Causes of the Malformation—Symptoms—Prognosis—Mode of Death—Modes of Compensation—Mental Anatomy—Theories Relating to the Etiology of Cyanosis—Treatment.	

APPENDIX A.

DIETARY FORMULÆ FOR INFANTS.

Fallard's Method of Preparing Milk for Infants—Lobley's Method—Meigs' Preparation—Liebig's Soup—Russell's Concentrate—Raw Meat—Beecham's Beef-tea—Hagar's Essence of Meat—Bastie's Condensed	PAGE
	391

APPENDIX B.

Observations on the State of the Liver in Infective Enterocolitis	PAGE 507
---	-------------

APPENDIX C.

Cases of Intermesoreption in the Small Intestine.—Intermesoreption of Bismuth into Colon.—Intagulation of the Cecum.—Cecum and Ileum.—Bismuth, Cecum, and Colon	PAGE 520
---	-------------

ERRATA.

- Page 18, line 1, *instead of* "symptoms which were," *read* "symptoms which was."
- " 33, " 35, *instead of* "might," *read* "may."
- " 126, " 11, *instead of* "although tubercle is never developed in this organ," *read* "although no tubercle is developed in the organ."
- " 154, " 25, *instead of* "if it arises," *read* "if oedema arises."
- " 166, " 19, *instead of* "in time," *read* "in turn."
- " 169, " 24, *omit* *unavoidable* after "which."
- " 271, bottom line, *instead of* "hydrothorax in addition to the pleurisy," *read* "pleurisy which, instead of being dry, as is usual with the pleurisy accompanying pneumonia, is attended by a considerable amount of serous exudation."
- " 335, line 6, *instead of* "protection from vaccination," *read* "protective power of vaccination."
- " 335, " 29, *instead of* "is proof of any," *read* "indicates that there is no."

DISEASES OF CHILDREN.

PART I.

CHAPTER I.

INFANCY AND CHILDHOOD.

HUMAN life consists of five periods—namely, infancy, childhood, youth, manhood, and old age. Infancy extends from birth till the close of first dentition, or to the age of two and a half years; childhood extends from the period of infancy to the age of fifteen years; youth from the period of childhood to the age of twenty, or twenty-five years; manhood from the period of youth to the age of sixty years; and old age completes the term of life.

Each of these periods has its distinguishing features. Infancy and childhood are especially interesting to the physiologist, because they are the periods of development, and of greatest functional activity; to the pathologist, because in them many interesting diseases occur, which are rarely or never observed in the other periods; to the physician and vital statistician, because in them there are the greatest amount of sickness and largest number of deaths.

Infancy and childhood concern us at present. In infancy the organs are delicately organized, containing a large proportion of water, and hence are easily injured. In this period the brain is rapidly developed—more so than any other organ; animal matter predominates in the bones; the arteries are relatively large, the muscles small; the superficial veins are small. Fat is absent from the interior of the body, but abundant, in well-nourished infants, underneath the integuments. The skin is delicate, and its temperature not much below that of the blood.

The pulse and respiration are more frequent than in youth or maturity; digestion is active, and the appetite therefore good. Hunger, when appeased, soon returns. In early infancy the senses are imperfectly developed, the eyes being attracted only by bright objects, and the sense of hearing affected only by loud noises. Sleep is the normal state in the first weeks of life; as the age of the infant advances, less and less sleep is required; but the oldest infants need more than children, and several hours more than adults.

The newly-born infant is apparently destitute of mental faculties. It seeks the breast by instinct, and it exhibits no perception or reflection. The loud cries with which it commences its existence are not from anger or suffering; they appear to be normal, like the act of nursing, and providentially designed in order to expand the lungs. It is not till the close, or near the close of the first month, that the gray substance of the brain begins to appear—the probable seat of the mind, and the source of all mental phenomena. Perception and curiosity are early manifested. The infant, as Edmund Burke has remarked, is constantly seeking new objects for its amusement, rejecting old play-things for such as possess more novelty. Reflection, a higher faculty of the mind, appears at a later period. The mind and the bodily organs in infancy are, in a high degree, impressionable. Anger is excited by trivial causes, but is easily appeased; and the various functions in the system are disturbed by agencies which in youth or manhood would have no appreciable effect.

CHILDHOOD is a period of great physical activity, and of rapid growth. The functions of the various organs are performed with more moderation than in infancy, and are less frequently deranged. The volume of the brain continues to increase rapidly, and it becomes firmer than in infancy. It is estimated that by the seventh year the weight of this organ has doubled. The mind now exerts a controlling influence over the actions of the individual. The digestive organs have changed, so that solid food is required. Most of the glandular organs are less active than in the greater part of infancy, and some of them, as the liver, are relatively smaller. I have said the greater part of infancy, because, in the first six months of life, some glands are slightly developed, and have but little functional activity, as, for example, the lachrymal glands and the intestinal follicles.

CHAPTER II.

CARE OF THE MOTHER IN PREGNANCY.

THE frequency of miscarriages and still-births, and the large number of ill-formed and puny infants, born to a prostrated and short existence, render imperative, on the part of the mother, a strict observance of the laws of health, and an avoidance of all exciting or perturbing influences during the time when the foetus is being developed. The diet should be plain and easily digested, but nutritious. There is often a craving in pregnancy for unusual articles of food. These may sometimes be allowed within certain limits, provided they are such as do not derange the stomach. Meats and animal broths, together with vegetables and farinaceous food, should constitute the ordinary diet, and should be taken at regular intervals.

Daily exercise, never violent, but moderate and gentle, is requisite. No exercise is better, none safer and more likely to contribute to cheerfulness and to healthy functional activity of the organs, than the ordinary household duties. Lifting heavy weights or work which, like washing and ironing, causes great and continued action of the abdominal muscles, should be avoided. Such exercise is highly injurious, and is apt to produce premature labor. Exercise in the open air, on foot or by an easy conveyance, conduces to the health of the mother, and the growth and development of the foetus. On the other hand, rapid riding over rough roads is one of the most dangerous modes of exercise. It has been known to destroy the foetus, which up to that time had been apparently vigorous. When such a result occurs, there is probably more or less detachment of the placenta.

It being a matter of the utmost importance that the health of the mother should continue good during gestation, any disease which she may have in this period, and which affects her nutrition or the character of her blood, should be promptly cured if practicable, and with the least possible reduction of the vital powers. Intermittent fever, occurring during gestation, should

never be allowed to continue. It seriously retards fetal development, and may produce miscarriage. Unless this disease is controlled by proper measures, the offspring, though born at term, is puny and emaciated. Syphilis, in the pregnant woman, also requires treatment. This disease, readily transmitted from the mother to the fetus through the ovum or the uterine circulation, may be eradicated by anti-syphilitic treatment of the mother, or at least so modified that the infant is born vigorous and healthy.

The pregnant woman should avoid all causes of undue mental excitement. This is almost as necessary as the avoidance of great physical exertion. There is, during pregnancy, unusual susceptibility to mental impressions, and this should be borne in mind not only by the woman herself, but by those who associate with her.

Strong emotions, whether of joy, sorrow, or anger, affect primarily the nervous system, but indirectly most of the organs of the body. Observations have long established the fact, that such emotions influence the state and functions not only of the digestive and glandular, but muscular organs, as the heart and uterus. Physicians are familiar with cases in which vivid mental impressions produced uterine contractions, and even miscarriage, or have disturbed the catamenial function. Therefore, the associations and cares of pregnant women should be such as conduce to cheerfulness and equanimity.

It is the popular belief, and the belief of many physicians, that vivid mental impressions sometimes have a direct effect on the development of the fetus. Many cases are on record in which infants were born with marks or deformities corresponding in character with objects which had been seen and had made a strong impression on the maternal mind at some period of gestation. Whether the mind of the mother exerts a controlling influence on the form and color of the fetus, is a subject of great interest to the psychologist as well as physiologist and physician, since it involves no less a question than the power and scope of the human mind. Violent emotions, it is admitted, may affect directly most of the important organs in the system. They may derange the liver, causing jaundice, accelerate, or for a moment suspend the heart's action, stimulate the kidneys, causing diuresis, or even the intestinal follicles, causing watery evacuations. But with all these organs the brain is connected by nerves which

anatomy reveals. On the other hand, the mother and fetus have a distinct existence as regards their nervous systems, and even their blood. Still, the multitude of facts which have accumulated justify the belief that deformity or other abnormal development of the fetus is, sometimes, due to the emotions of the mother. Some of the cases related by Dr. Whitehead in his work on hereditary diseases, are very striking and difficult to explain, on the ground of coincidence. I have met the following cases. An Irish woman of strong emotions and superstitious was passing along a street in the first months of her gestation, when she was accosted by a beggar, who raised her hand, destitute of thumb and fingers, and in "God's name" asked for alms. The woman passed on, but reflecting in whose name money was asked, felt that she had committed a great sin in refusing assistance. She returned to the place where she had met the beggar, and on different days, but never afterwards saw her. Harassed by the thought of her imaginary sin, so that for weeks, according to her statement, she was distressed by it, she approached her confinement. A female infant was born, otherwise perfect, but lacking the fingers and thumb of one hand. The deformed limb was on the same side, and it seemed to the mother to resemble precisely that of the beggar. In another case which I met, a very similar malformation was attributed by the mother of the child to an accident occurring to a near relative, which necessitated amputation during the time of her gestation. I examined both of these children with defective limbs, and have no doubt of the truthfulness of the parents. In May, 1868, I removed a supernumerary thumb from an infant, whose mother, a baker's wife, gave me the following history: No one of the family, and no ancestor, to her knowledge, presented this deformity. In the early months of her gestation she sold bread from the counter, and nearly every day a child with double thumb came in for a penny roll, presenting the penny between the thumb and the finger. After the third month she left the bakery, but the malformation was so impressed upon her mind, that she was not surprised to see it reproduced in her infant.

Professor William A. Hammond, of this city, in an interesting paper, which he has recently published on the "Influence of the Maternal Mind, etc." (*Quarterly Journal of Psychological Medicine*, January, 1888), says: "The chances of these instances, and

others, which I have mentioned, being due to coincidence, are infinitesimally small, and though I am careful not to reason upon the principle of *post hoc, ergo propter hoc*, I cannot, nor do I think any other person can, so matter how logical may be his mind—reason fairly against the connection of cause and effect in such cases. The correctness of the facts can only be questioned; if these be accepted, the probabilities are thousands of millions to one, that the relation between the phenomena is direct." Professor Dalton also says (*Human Physiology*), "there is now little room for doubt that various deformities and deficiencies of the fetus, conformably to the popular belief, do really originate in certain cases from nervous impressions, such as disgust, fear, or anger, experienced by the mother." The observations on which this belief is based relate both to man and the lower animals. A very strong argument in its support is, as Professor Hammond remarks, the popular opinion, which dates back to the time of Jacob (*Genesis xxx.*). An almost universal sentiment, retaining through centuries, is rarely wholly fallacious. It has some truth for its foundation. Particularly is this true, when the subject is one of observation.

If maternal emotions affect the development of the exterior of the fetus, as observations show, and physiologists admit, the presumption is strong, that they may affect also the proper development, and adjustment of the parts of the brain, an organ so complex, and delicate, and may therefore give rise to idiocy. Dr. Seguin (*Idiocy and its Treatment, etc.*, New York, 1866) thus remarks on this point: "Impressions will, sometimes, reach the fetus, in its recess, cut off its legs or arms, or inflict large flesh wounds, before birth, . . . from which we surmise that idiocy holds unknown, though certain relations to maternal impressions, as modifications of placental nutrition."

In view of such important facts, the duty of the pregnant woman is rendered the more imperative to avoid the presence of disagreeable and unsightly objects, as well as all causes of excitement, and to remove, as soon as possible, vivid and unpleasant impressions, by quiet diversion of the mind.

CHAPTER III.

MORTALITY OF EARLY LIFE—ITS CAUSES AND PREVENTION.

No fact is better known in the profession, than that the first years of life constitute the period of greatest mortality.

In England, where there is an accurate registration of births and deaths, statistics show fifteen deaths in every hundred infants, in the first year of life, and between four and five deaths in the first month. Statistics on the continent correspond with those in England, as regards the periods of greatest mortality. Quetelet says, ". . . there die during the first month after birth, four times as many children as during the second month after birth, and almost as many as during the entirety of the two years that follow the first year, although even then the mortality is high. The tables of mortality prove, in fact, that one-tenth of children born die before the first month has been completed."

In this country, in consequence of deficient registration of births, the percentage of deaths to births cannot be accurately ascertained. In this city, 53 per cent. of the total number of deaths occur under the age of five years, and 26 per cent. under the age of one year. According to the last census, that of 1865, there were, in this city, 95,920 children under the age of five years, and during the five years ending with 1865, 49,600 children five years old and under had died. Therefore, according to these statistics, more than one-third of all the infants born in this city die under the age of five years. An error, however, occurs from the fact that, while the death statistics were complete, it is known there were more children in the city than were enumerated in the census returns. Still it may, I think, be safely stated that one-fourth of the children born in this city die before the age of five years.

In less crowded cities and the rural districts, it is known that the percentage of deaths in the first years of life to the total number of deaths, is considerably less than in New York city, but it is nevertheless large.

As the child advances toward puberty, the liability to sickness and death gradually diminishes, but even the last years of childhood present a considerably larger percentage of deaths to the population than does youth or manhood.

The causes of this great mortality of infants and children, and the means of diminishing it, deserve careful consideration.

Some of the causes which conspire to produce this mortality are in a measure unavoidable. Such are congenital vices of formation of internal organs. Many of the internal malformations necessarily occasion an early death. Cases of anencephalus, most cases of congenital hydrocephalus, of spina bifida, of cyanosis, are fatal before the close of infancy. These defects of formation we cannot detect before birth, and their causes are often obscure. Some of them seem to result from inflammation, believed to be, occasionally, syphilitic, developed at some period of fetal existence. Other internal malformations are attributable to perturbing influences, operating temporarily on the mother during gestation. But in a large proportion of cases, we cannot assign the cause. Obviously, only partial success can attend our efforts, as regards prevention in these cases, and almost no success, as regards the use of remedial measures.

Another obvious cause of the great mortality of early life, is natural feebleness of system, especially in infancy. The younger the patient, prior to the middle period of life, the sooner are the vital powers exhausted by disease. Hence a larger proportion of infants succumb to the same malady than children, and a larger proportion of children than adults. This statement is true of infancy and childhood in general. It is a law in nature, and cannot be changed by art. But there are many infants born with hereditary disease, or a strong predisposition to disease, through a fault, which is, in a degree, remediable, in the system of one or both parents. Such are cases of syphilis, scrofula, rachitis, or tubercle. Parents seriously affected by such ailments cannot, without corrective treatment, have healthy offspring. Their children are among the first to droop and die, either directly from inherited disease, or from feebleness of constitution, which such disease entails, and which renders them an easy prey for other diseases. The duty of the physician, as regards such parents, is obvious. He may, by therapeutic and hygienic measures, secure a more healthy progeny, and, so far as he can do this, he aids in diminishing the

infantile mortality. He may sometimes, by timely measures directed to the infant, save its life.

The subject of hereditary disease is one of great interest and importance, especially as regards the city population. Inherited affections are less common in the country, but in the city they contribute largely to the number of deaths in early life.

Another important cause of the great mortality of infants and children, is the fact that they are peculiarly liable to certain severe and fatal diseases. The zymotic diseases, which, as a rule, occur but once, are more common at this age than subsequently. Some of these, as scarlet fever, greatly increase the number of deaths. The zymotic diseases are for the most part infectious. Hence they are very prevalent and fatal in the cities, where there is much greater intercourse of children than in the country. Scarlet fever is one of the six most fatal diseases in New York city. The prevention of the zymotic diseases obviously depends, in great measure, on isolation, which it is the duty of the physician to advise. Boards of health, or civil authorities, may also do something as regards the schools, to prevent the spread of these diseases. One of these zymotic diseases, the most dreaded of all, namely, smallpox, the physician has the power to prevent. Some of the most fatal diseases of life, not zymotic, as croup and capillary bronchitis, also occur in infancy and childhood, materially increasing the mortality. These local affections cannot be prevented by the physician, but can only be prevented by hygienic management on the part of families.

Another obvious and important cause of the mortality of early life, is the anti-hygienic condition or state in which many children live in consequence of the poverty or gross negligence of parents.

Residence in insalubrious localities, personal and domestic uncleanliness, exposure without proper protection to vicissitudes of weather, are fertile causes of sickness and death. Hence a reason of the great infantile mortality among the city poor, who live in damp and dark alleys, and in crowded and filthy tenement houses, breathing night and day an atmosphere loaded with noxious gases. All physicians are aware how the malignant diseases, such as Asiatic cholera, cholera infantum, diphtheria, and typhus fever seek the quarters of the city poor, and what terrible havoc they make there. All are aware, also, what wonderful recoveries frequently occur when feeble and emaciated infants,

gradually sinking with chronic disease, induced in great measure by this malaria, are transferred from such localities to the pure air of the country.

Careless management of young children, as regards dress, increases greatly the liability to local diseases; such diseases as occur from exposure to cold. These are inflammatory affections, seated chiefly upon the mucous surfaces, and not unfrequently involving the lungs. Adults, aware of the effect of sudden change of temperature from warm to cold, or of exposure to currents of air, protect themselves by additional clothing: Such precautionary measures are often lacking in the management of young children, and hence one cause of their great liability to local affections, both of the respiratory and digestive organs.

Bouth, in his excellent treatise on Infant Feeding, says: "Among the most pernicious influences to young children, however, we may include cold. The change of temperature from 45° to 4° or 5° below zero, as before stated, producing an increase of mortality in London alone of three to five hundred. As out of one hundred deaths, however, from all specified causes, nearly twenty-four occur to children under one, and thirty-six to children under five; the great increase of mortality to children by cold, is thus, at once, made obvious. Indeed, it is a household word amongst us, which takes its origin from the Registrar-General's returns, that a very cold week always increases the mortality of the very young and the very aged."

Lastly, a very important cause of mortality in early life is the use of improper food. In infants, artificial feeding in place of the aliment which nature has provided for them, and, in children, the use of innutritious or indigestible articles of diet, give rise to diarrhoeal maladies, emaciation, and death in numerous instances. Sometimes, also, defective alimentation is the cause of scrofulous or tuberculous ailments, and sometimes it gives rise to a cachexia or feebleness of system, which, without engendering any positive disease, renders those thus affected less able to support disease induced by other causes. A committee, of which Prof. Austin Flint, Jr., was chairman, appointed in 1867 to revise the "dietary table of the Children's Nurseries on Randall's Island," state, with much truth and force: "Children . . . are not capable of resisting bad alimentation, either as regards quantity, quality, or variety. At that age the demands of the system for nourish-

ment are in excess of the waste; the extra quantity being required for growth and development. If the proper quantity and variety of food be not provided, full development cannot take place, and the children grow up, if they survive, into puny men and women, incapable of the ordinary amount of labor, and liable to diseases of various kinds. This is frequently illustrated in the higher walks of life, particularly in females; for many suffer through life from improper diet in boarding schools, due to false and artificial notions of delicacy or refinement. After a certain period of improper and deficient diet in children, the appetite becomes permanently impaired, and the system is rendered incapable of appropriating the amount of matter necessary to proper development and growth."

Improper feeding, like other causes of mortality, is much more injurious, much more frequently the cause of death in the city than country. Statistics in Europe, as well as this side of the Atlantic, establish this fact. It is in infancy, and especially in the first year, that the use of unwholesome food entails the most serious consequences. No artificially prepared food is a good substitute for the mother's milk, and hence artificial feeding of the infant, unless under the most favorable circumstances, results disastrously. In the country, where salubrious air and sunlight conspire to invigorate the system, and a robust constitution is inherited, and where cow's milk fresh and of the best quality is readily obtained, lactation is not so necessary for the well-being of the infant; but in the city its importance cannot be too strongly urged.

The foundlings of the cities afford the most striking and convincing proofs of the advantages of lactation. In some cities foundlings are wet-nursed, while in others they are dry-nursed, and the result is always greatly in favor of the former. Thus, on the Continent, in Lyons and Parthenay, where foundlings are wet-nursed almost from the time that they are received, the deaths are 33.7 and 35 per cent. On the other hand, in Paris, Rheims, and Aix, where the foundlings are wholly dry-nursed, their deaths are 50.8, 65.9, and 80 per cent.

In this city the foundlings, amounting to several hundred a year, were, till recently, dry-nursed; and incredible as it may appear, their mortality, with this mode of alimentation, nearly

reached 100 per cent. Recently wet-nurses have been employed, for a part of the foundlings, with a much more favorable result.

These facts, to which others might be added from the experience of European cities, show the importance of lactation as a means of reducing infantile mortality in the cities. What has been stated as regards the result of artificial feeding of foundlings, is true, in great measure, in reference to all city infants. The ill effect of artificial feeding is well known in this city, and it is the common practice in families to employ a hired wet-nurse, if, for any reason, the mother's milk is insufficient.

When the infant has reached the age at which it is proper to wean it, the digestive organs are less frequently deranged by errors of diet. More substantial food, and considerable variety in it, may now be not only safely allowed, but are required by the wants of the system. Still, the feeding of children in health, and much more in sickness, is a subject of great importance. Therefore lactation, and the diet of infancy and childhood, will occupy our attention in the following pages.

CHAPTER IV.

LACTATION.

It is desirable that the infant, as soon as it requires nutriment, should receive breast milk. If it is fed, for a few days, with the bottle or spoon, it may be difficult finally to induce it to take the breast; therefore it is well to determine early whether the mother will be able to wet-nurse her infant, so that, if unable, suitable provision may be made.

The matter of determining, beforehand, the capability of the mother for wet-nursing has been investigated by Dr. Donné of Paris, and in his treatise on Mothers and Infants, he describes the mode in which it may be ascertained. The desired information, in his opinion, may be acquired by examining the colostrum, which is secreted, in small quantity, in the last months of gestation, and which can be squeezed from the breast in sufficient quantity for inspection.

In some women, according to Dr. Donné, the colostrum is so scanty that only a drop, or half a drop, can be obtained from the nipple by careful pressure. This will be found by the microscope, to contain but few milk globules, ill-formed, and a few granular bodies, such as the colostrum ordinarily contains. Such women almost invariably furnish poor milk, and in small quantity. In other women the colostrum is abundant, but thin, resembling gum water; it lacks the yellow streaks, and viscous character of ordinary colostrum, and it flows readily from the nipple. The milk of such women is sometimes scanty, sometimes abundant, but it is watery and deficient in nutritive principles. In a third class of women, the colostrum is pretty abundant, and it contains yellowish streaks, of more or less consistence, which are found to be rich in milk globules, of good size, and without the admixture of mucous globules. Women furnishing such colostrum in the last weeks of gestation will have sufficient milk, and of good quality. These latter women make the best wet-nurses.

Hindrances to Lactation and Physical Conditions Rendering it Improper.

The primipara often experiences difficulty in wet-nursing in consequence of a depressed state of the nipple. It is not sufficiently prominent to be readily grasped by the mouth, and after ineffectual attempts, the infant becomes fretful when applied to the breast, and, perhaps, for a time refuses it altogether. Multiparae occasionally experience the same inconvenience, but it is not common when there has once been successful lactation. By calmsness and perseverance on the part of the mother, the infant can usually be made to seize the nipple in the course of a week.

Depression of the nipple is, to a certain extent, the result of pressure upon it by the dress during gestation. The state of the nipples should, indeed, in those who have never suckled, receive early attention, even before the birth of the infant. Tightness of dress around the breast, as indeed upon every part of the body, should be avoided, and from time to time gentle traction should be made upon the nipple if it is depressed. It may be drawn out by the fingers of the mother several times each day, or by a common breast pump, or by suction with a tobacco pipe, the edge of

the bowl having been smoothed. Occasionally, in these cases of deficient nipple, the mother, fatigued and discouraged by her frequent ineffectual attempts to induce the infant to nurse, becomes feverish and excited, so that the quantity of her milk is sensibly diminished. The physician should assure her, as he usually can with confidence, that in a few days, as the baby becomes a little stronger, there will be no difficulty in its nursing. Some women are unrelenting in their endeavors to procure nursing. This should be forbidden, since the lack of sleep, and the nervousness which such constant attention produces, tend to defeat the object which they have in view, by diminishing the secretion of milk. The application of the infant to the breast once in an hour and a half to two hours is quite sufficient. In some cases, when practicable, the aid of another woman, whose infant is but little older, is invaluable. The exchange of infants for a few times may remedy the difficulty.

Occasionally lactation is rendered difficult and painful by too long delay before applying the infant to the breast. When the mother has rested a few hours after her confinement, from three to six in ordinary cases, lactation may commence. There is, at first, but very little milk, often only a few drops, but the secretion is promoted by nursing, so that the requisite amount is sooner obtained than when the infant is kept from the breast till the second or third day. If, as some physicians advise, smoking is deferred till the breasts are full and tender, and if, as is often the case with primiparae, the nipples are also tender, many mothers lack the fortitude required to allow their infants to obtain a sufficient amount of milk. Excoriated and fissured nipples constitute a serious impediment to lactation. They are very sensitive on pressure, and are long in healing. They are fully described in works which relate to female diseases, and their treatment pointed out. Occasionally fissured nipples do harm to the infant by the blood which escapes and is swallowed with the milk. A case is related in which positive indigestion was caused in this way, the infant vomiting after each nursing milk mixed with blood. The local hindrances to lactation described above can, in most instances, be relieved in the course of a few weeks.

There is, occasionally, a constitutional state of the mother, which necessitates either the employment of a hired wet-nurse, or weaning. This is the case when there is a strong tendency to

tuberculosis. If the complexion is pallid, and the system at all emaciated, and suckling is attended by more or less exhaustion, and if with fair trial of wine and tonics there is no improvement, the physician is justified in forbidding farther attempts at wet-nursing. If there is, under such circumstances, an hereditary tendency to tuberculosis, it is his duty to interdict it positively. The opinion of the physician, in such a matter, should be formed after mature deliberation. There are many women who, suffering temporarily from depression, and discouraged, are ready at once to abandon their infants to the care of others, with the least encouragement on the part of the physician to do so, but who, by attention to their own health, and especially by taking more sleep, soon recover from their depression and become good wet-nurses. On the other hand, night-sweats, a cough, and progressive decline in health, show the seed of immediate suspension of wet-nursing.

Sometimes women, prior to pregnancy, present ineluctable evidence of tuberculosis, but by the improved general health which attends pregnancy, the disease is temporarily arrested. Such women should never suckle their infants. If they do, they soon lose all that was gained, and the disease advances rapidly. These objections to wet-nursing in such a state of health apply to the mother. There are also objections as regards the infant. The milk of those in decidedly infirm health, is deficient in nutritive principles. Their infants, therefore, are ill-nourished, and, if they have inherited a predisposition to tuberculosis, there is great danger that this disease will be developed in them; whereas with healthy wet-nursing, even a strong predisposition may remain latent. M. Donné relates the following instructive cases, which show the danger which sometimes attends suckling, and the imperative necessity which may arise of discontinuing it. "A very light-complexioned young mother, in very good health, and of a good constitution, though somewhat delicate, was nursing for the third time, and as regarded the child successfully. All at once this young woman experienced a feeling of exhaustion. Her skin became constantly hot; there were cough, oppression, night-sweats; her strength rapidly declined, and in less than a fortnight she presented the ordinary symptoms of consumption. The nursing was immediately abandoned, and from the moment the secretion of milk had ceased, all the troubles

disappeared." "A woman of forty years of age . . . having lost, one after another, several children, all of whom she had put out to nurse, determined to nurse the last one herself. . . . This woman, being vigorous and well-built, was eager for the work, and, filled with devotion and spirit, she gave herself up to the nursing of her child with a sort of fury. At nine months, she still nursed him from fifteen to twenty times a day. Having become extremely emaciated, she fell all at once into a state of weakness, from which nothing could raise her, and two days after the poor woman died of exhaustion."

Constitutional syphilis in the mother does not contra-indicate lactation. It is probable that the infant also has it. The mother should take anti-syphilitic remedies, which will eradicate the disease in herself, and also, if it be present, in the infant. Febrile affections, also, do not in general contra-indicate lactation. They may, however, for a time, diminish the quantity of milk, or impair its quality. If, however, the mother is in a critical state, or much reduced, whatever the disease, suckling should cease. Whether or not the infant should be taken from the breast, if the mother is suffering from one of the essential fevers, depends on the degree of her exhaustion. Twice I have known newly-born infants nurse their mothers through attacks of scarlet fever, without contracting it, but suffering immediately afterwards from severe and protracted eczema. In the country, where artificially-fed infants as a rule do well, it might be best to wean if the mother is affected with such a disease, but in the city eczema is less dangerous than the diarrhoeal affections, which early weaning is apt to entail. In most cases of typhus or typhoid, weaning or procuring a wet-nurse is necessary, on account of the depression of the vital powers which this disease produces.

Inflammatory affections, unless of a dangerous character, do not ordinarily interfere with lactation, except that the quantity of milk may be somewhat diminished. In severe inflammation, it may be so necessary to husband the strength, or to keep the patient perfectly quiet, that suckling her infant would be injudicious. It should, then, be transferred to a wet-nurse or weaned. Inflammation of the breast often presents an impediment to lactation. It is a common and painful affection, suspending, or greatly diminishing the secretion of milk in the affected gland. Nursing should cease as soon as there are evident signs of inflammation,

unless it is limited to a small part of the gland. General heat of the breast, tenderness and induration extending over a considerable part of it are signs which indicate the immediate removal of the infant from it. Lactation must be restricted to the unaffected side. It is often the case that the volume of the inflamed gland is considerably increased from the afflux of blood to it, and from the interstitial exudation, while it contains little or no milk, and attempts at lactation, under such circumstances, are injurious to the mother as well as infant. The cause of the swelling should be explained to the mother, who commonly attributes it to the accumulation of milk, and worries herself and the infant, in attempting to make it nurse. As the inflammation abates, by resolution, or more commonly by suppuration, and the normal secretion returns, the first milk which is apt to be thick and stringy, should be rejected, after which the infant may nurse as usual. Occasionally, the abscess, which has formed in the breast, connects with a lactiferous tube, so that pus may, on suction, escape from the nipple. If this occur, of course, lactation should be interdicted, until pure milk is obtained. Pus in the milk can sometimes be detected by the naked eye. It presents a yellowish or greenish color, occurring in streaks, when not intimately mixed with the milk. When it is intimately mixed, and in small quantity, it cannot be detected by the naked eye, but the microscope reveals the pus globules. M. Donné relates a case in which he discovered pus globules by the microscope, although there were at first no other evidences of an abscess, and doubts were expressed in reference to the accuracy of his observation. Finally, an abscess pointed and discharged.

Sometimes, when the inflammation abates, the secretion does not return, and, worse still, occasionally the inflammation has occurred so near the nipple that the lactiferous tubes are permanently closed by it, so that though milk forms in the breast, there is no escape for it. Therefore lactation must be entirely from one breast.

Facts and Rules in reference to Lactation.

The new-born infant should nurse every hour, or every second hour, during the day. At night, if the mother is delicate, and her milk not abundant, it may be fed, once or twice, with a little

cow's milk. It is better to select, for this purpose, the upper third of the milk, after it has stood two or three hours, and use it diluted with twice the quantity of water. If the mother is robust, it is better not to feed the infant at all, but to allow it to nurse once or twice during the night. No infant, in ordinary health, really requires the breast more than once during the hours which the mother needs for rest; and by a little perseverance on her part the habit may be established, so that the infant is satisfied if it receives the breast no oftener. Many young mothers commence the duty of suckling with too much ardor. Exerting themselves to the utmost for the good of their offspring, they are awake, night after night, giving their breast at every cry, till they soon find that their strength is failing, and with it, also, their milk. Their self-devotion necessitates early weaning, whereas had they exercised more regard for their own health, and learned to hear with composure the cries, which often do not indicate any bodily want or distress, they might continue to suckle their infants during the usual period.

The milk secreted during gestation, and immediately after the birth of the infant, differs in its gross appearance, as well as chemical and microscopical characters, from the milk which is ordinarily secreted in a state of health. It is termed *colostrum*. It has a turbid and yellowish appearance, and is somewhat viscid. It is decidedly alkaline, and it undergoes lactic acid fermentation more readily than common milk, and it also contains more solid matter. There is an excess of fat, of salts, and, according to Simon, also of sugar. It appears from Simon's analysis, that the



Milk (Colostrum)



Colostrum (Common)

solid matter of colostrum is about seventeen per cent., while that of the ordinary breast milk is about eleven per cent.

Examined by the microscope, the colostrum is seen to contain

oil globules and a viscid substance, which often assumes an ovoid or globular form, but which also exists in irregular masses of considerable size. This substance has been thought by some to be mucus, but it is dissolved by acetic acid and potash, and it is tinged yellow by a watery solution of iodine. It is, therefore, to be regarded as albuminous. Imbedded in this substance are oil globules, which are for the most part of small size, while the free oil globules of colostrum are larger than those occurring in healthy milk. This viscid substance, with the imprisoned oil globules, constitutes what has been designated the "colostrum corpuscles." Some pathologists have erroneously considered the "colostrum corpuscles" to be compound granular cells. The compound granular cell or corpuscle is a cell which has undergone fatty degeneration. It is distended with oil globules to perhaps twice or thrice its normal size. On the other hand, examination of the "colostrum corpuscles" fails to detect a cell-wall, and the large and irregular size of some of these corpuscles negatives the idea that they are cells. The oil globules contained in the viscid substance are more readily acted on by ether than are the free oil globules.

The colostrum is replaced by milk of the normal character, usually in six to eight days; sometimes as early as the third or fourth day after delivery. In exceptional instances, the colostrum does not disappear for several weeks, and it may reappear at any time during lactation, as a consequence of derangement of the system, or from disease. It is assimilated with difficulty by the digestive organs of the infant, producing usually a laxative effect. It, therefore, aids in the removal of the meconium, and being a normal secretion in the first week of lactation, it is to be regarded as beneficial. Continuing longer than the first week, its effect is deleterious. It produces evident derangement of the digestive organs, and the infant that habitually nurses it never thrives. It has diarrhoea or vomiting, becomes more or less emaciated, and suffers from colicky pains. Sometimes an extreme degree of exhaustion is reached before the cause is suspected, for, if the milk is pretty abundant, the admixture of colostrum with it cannot be detected by the naked eye. The microscope alone reveals it. A few months since I was asked to examine an infant six weeks old, whose history was the following: The mother had for years been troubled more or less with dyspeptic symptoms

but had otherwise been in good health. The infant at birth was fleshy, but it had never after the first week thriven like other infants. It nursed regularly, and there was apparently a sufficient amount of milk, but it vomited as soon as it ceased nursing; it was much emaciated, and the bowels were habitually constipated. The digestive organs of the infant had been in this unhealthy state, with little variation from the first week, and it was very evident from the emaciation and exhaustion, that it must soon perish, unless some change were made. The milk of the mother did not present any unusual appearance to the naked eye, but under the microscope, the coöstrum-corpuscles were observed. A wet-rubber was immediately obtained, and from that moment the gastro-intestinal symptoms disappeared, and there was rapid recovery. This case shows at once the evil effects of the coöstrum, and the necessity of making a microscopic examination of the milk in cases in which lactation disagrees with the infant.

Human Milk.

The specific gravity of human milk is about 1032. It has been carefully analyzed by different chemists, with nearly the same result. The following table, prepared by M. Vernois and Boiquard, gives the proportion of the various ingredients in 1000 parts:—

Water	808.66
Sugar	43.64
Casein and Extractive	39.24
Butter	25.44
Salts (ash)	1.38
	<hr/> 1000.00

Milk being the sole food of early infancy, contains all the nutritive principles which are required for the growth and repair of the different tissues. The casein is an albuminous principle, the butter and sugar are combustible substances, and most of the salts which occur in the different tissues exist primarily in the milk. Phosphate of lime, phosphate of magnesia, phosphate of the peroxide of iron, chloride of potassium, chloride of sodium, and soda were discovered by Haidlen in the milk of the cow. Alkaline carbonates, according to Lehmann, also occur in cow's milk, and probably in other kinds of milk. Epithelial cells are also

frequently present, derived from the lining membrane of the lactiferous tubes.

Modifications of the Milk in Consequence of the Diet.

Fresh milk should give an alkaline reaction, but in certain states of ill health, or after the use of certain articles of food, the reaction is acid. Mothers are well aware of the ill effects, as regards the infant, which follow their use of indigestible, or acrid food; and, if prudent, they avoid it. The milk, if the diet of the mother is improper, may become so strongly acid as to cause colicky pains and diarrhoea. The following observations in reference to cow's milk are instructive. We may infer from them that the regimen of the mother exerts a decided influence on the alkalinity of her milk. According to Reuth (*Infant Food*, 189, page 285), stall-fed cows almost always give acid milk. Dr. Mayer, of Berlin, examined the milk from a considerable number of cows with the following result:—

(a.) Of cows fed with leewards' loss, red potatoes, rye bran, and wild hay, in five instances the milk was slightly sour; in one very much so.

(b.) Of forty cows fed with potato mash, barley husk, and clover and barley straw, in ten, which were examined, the milk was sour; in three very sour.

(c.) From among fifty cows fed on potato husks, barley husks, and wild hay, five were examined, and in all the fresh milk was sour.

(d.) From forty-two cows fed on potato mash, husks, wild hay, and rye straw, out of twelve selected for examination, the fresh milk of all was sour.

(e.) From six cows fed by a chief gardener on coarse beet-root, red potato, bran mash, and hay, the fresh milk was slightly sour.

(f.) From five cows fed by a cow feeder on luke-warm bran mash and hay, in four the fresh milk was quite neutral, in one it was decidedly alkaline. (Reuth.)

The above observations of Dr. Mayer were made in the winter season, and it is possible that the acidity may have been partly due to the confinement of the cows in stalls. But that it was mainly due to the food is evident from the fact that it was greater with some kinds of food than others. Cows' milk is not so alkali-

line as human milk, and is therefore more readily rendered acid. Still, what Dr. Mayer observed in reference to the cow exemplified a fact of general applicability, namely, that certain kinds of food may affect the alkalinity of the milk, whether human milk or that of animals.

The relative proportion of the different ingredients of the milk varies according to the diet. If the diet is poor, the amount of water increases, and that of butter and caseum diminishes. Lehmann says, in reference to the milk of animals (*Phys. Chrestomathy*, vol. ii. p. 65): "From experiments made on bitches, it would appear that a vegetable diet renders the milk richer in butter and sugar; while the solid constituents are augmented when a sufficient quantity of mixed food is given. Peligot found the milk of an ass most rich in casein when the animal had been fed on beet-root; whilst it was richest in butter when the food had consisted of oats and lucerne. Fat food increases the quantity of the butter. Bonodagaiah found the milk of a cow richer in casein when the animal had been fed on potatoes than when other food was taken. Robes found that the milk of cows which were at grass was much richer in fat than when the animals had stood all night in their stall without food; but Playfair found, on the contrary, that the quantity of butter in the milk increased during the night as much as during their stall-feeding, but that the quantity of butter in the milk was considerably diminished by the motion of the animals in the fields." Simon made the following analyses of the milk of a poor woman. She was suddenly, during the period of lactation, deprived of the means of support, so that her food was insufficient in quantity, and of poor quality. The amount of her milk was not diminished by privation, but the solid constituents were reduced to 86 parts in 1000. After this, for a time, her diet was nutritious and abundant, the quantity of milk was increased, and the solid constituents amounted to 119 parts in 1000. Her diet was again reduced, with a reduction of the solid elements to 88 in 1000, and, at a later period, the diet was again nutritious, with an increase of the solid elements to 126. The chief variation observed in the milk of this woman was in the amount of butter.

Modifications in the Milk from its Retention in the Breast.

M. Poligot has clearly demonstrated, that the longer milk is retained in the breast the more watery it becomes. This is explained by supposing that the more solid portion is first absorbed. Therefore, the milk is richer the more frequently it is removed from the breast. A similar fact, which has the same explanation, has long been known, namely, that the first milk taken from the breast is thinnest, while that which flows last is richest. That first removed has remained longest in the gland, while that which comes last is but recently secreted.

A knowledge of this fact is of considerable practical importance. The milk, as M. Donné has shown, may be too rich, so as to cause indigestion, with more or less enteralgia in the infant. Some nurslings, if the milk is too rich and abundant, reject a part of it by vomiting, but others do not, and suffer the consequences in derangement of the digestive organs. For such cases the remedy is, to give the breast less frequently, by which a less amount of milk is taken, and milk of a poorer quality. On the other hand, if there is poverty of the milk, and the infant is insufficiently nourished, the milk is more nutritious if the nursing be at short intervals.

Modification of Milk by Age and by Nervous Impressions.

The composition of the milk varies, also, according to the age of the infant. Simon analyzed the milk of a woman at intervals for the period of about six months. In this case the amount of casein at first was small, but the quantity increased during the two months succeeding delivery, after which it was nearly stationary. A similar increase was observed in reference to the saline substances. The sugar, on the other hand, diminished in quantity as the infant grew older, its maximum amount being in the first and second months. The quantity of butter in the milk varies from day to day more than the other elements.

Many observations have been published which show that the composition of the milk may be materially changed by mental impressions. The infant has died suddenly in the act of nursing, after the mother had been violently excited. Such a case is related by Tournaï. The infant ceased nursing, gasped, and died

in the mother's lap. In other cases convulsions have occurred. MM. Boesigerel and Vernois made the chemical analysis of the milk of a woman in a state of nervous excitement, and found that the solid constituents were diminished to 71 parts in 1000, the most marked diminution being in the butter, which was only about 5 parts. In a case related by Parmentier and Deyoux the milk became watery and viscid, and remained so till the nervous attacks, from which the patient suffered, had ceased. Dairywomen are well aware how ill-treatment and the separation of the calf from the cow disarranges the milk which she yields. A new milkman seldom obtains as much milk as one with whom the cow is familiar. Bouchet, alluding to the influence of the moral affections on the secretion of milk, makes the following remark, the truth of which most mothers will acknowledge: "It is also a fact, that the sight of the nursing, the idea of seeing it at the breast, and the joy which certain mothers thence experience, exercise a moral influence over the secretion of the milk entirely independent of their will. They feel the draught of milk as soon as they behold their child, or think of it too deeply; and in a woman who saw her child fall to the ground, the flow of milk ceased, and did not reappear until the child, having quite recovered, attempted to take the breast.

Modification of the Milk by the Catamenial Pinction and Pregnancy.

The catamenia reappear in most women before the close of lactation, often by the fifth or sixth month after delivery. If this function is re-established in the normal manner, that is, without any derangement of the system, without pain or undue profuseness, no unfavorable result ordinarily occurs with the infant. On the other hand, if the mother suffer any disturbance of the system, or if the menses are profuse, the lactical secretion may be so changed, that the infant is injuriously affected by it. The symptoms produced are those of indigestion, such as abdominal pains, more or less vomiting, and diarrhoea. This result is, however, in my experience, quite exceptional. In rare instances, more dangerous symptoms occur in the infant. A case has been reported to me in which, at each catamenial period, the nursing was excited with convulsions.

MM. Boesigerel and Vernois have investigated the character

of the milk during the catamenia in three cases. Their examinations showed a moderate increase in the solid constituents. The butter and caseum were increased, while the sugar was diminished. The variation from normal milk was not, however, such as would be likely to cause any serious indisposition. If the menses reappear with regularity, when the infant has attained the age of ten or twelve months, they should be considered as designed to supersede the secretion of milk, which, indeed, usually begins to diminish. Weaning is then proper. If the menses return early in the period of lactation, and give rise to symptoms in the infant in consequence of the altered quality of the milk, it is advisable to allow but little nursing during the catamenia, and to employ artificial feeding in place till the flow of blood ceases.

The change produced in the milk by pregnancy is, in general, more injurious to the nursing than that caused by the reappearance of the menses. The milk of the pregnant woman is apt to contain more or less of that viscid substance, which characterizes colostrum. Still the milk of pregnancy does not, ordinarily, derange the digestive function as much as colostrum, in the first weeks of lactation, for pregnancy rarely occurs till after the infant is five or six months old, when the organs of digestion are less readily disturbed. The injurious effect of pregnancy on the infant is shown by vomiting or diarrhoea, by restlessness and occasional abdominal pains, in fine, by symptoms of indigestion. In many cases, however, these symptoms do not occur, and the infant, though nursing regularly, continues to thrive. No doubt, as a rule, the infant should be weaned when there are clear evidences of pregnancy, but under certain circumstances weaning is injudicious. I have, on different occasions, been called to infants, in midsummer, dangerously sick with diarrhoeal attacks induced by this cause. These infants were, perhaps, doing well, or suffering but little from indigestion, when the mothers suspecting themselves pregnant, at once withdrew them from the breast, and cholera infantum or a kindred disease was the result. No infant in the city should be weaned in the hot months. It is much safer, though there are indubitable signs of pregnancy, that it continue nursing till the cold weather. The better method is, however, under such circumstances, to employ a wet-nurse, or to remove the infant to the country, and wean it there. In cold weather, it

is usually safe to wean an infant, in the city, after it has reached the age of five or six months.

The milk frequently contains other ingredients in addition to those which have been mentioned. Thus a large number of medicinal substances, taken by the mother, may enter the milk, so as to produce their characteristic effect on the infant. It is a well-known fact, that the peculiar flavor of certain vegetables, taken as food, may be noticed in the milk. It is believed, also, that the specific virus of the zymotic diseases, at least certain of them, may enter the milk, so as to give rise to the same diseases in the infant.

Quantity of Breast Milk required by the Infant.

In a paper published by Dr. W. H. Cumming, in the *American Journal of Medical Science*, July, 1858, it is estimated that the amount of milk secreted per day by a healthy woman is one and a half to two quarts, and double the quantity if two infants are suckled. Bouth (*Infant Feeding*, page 87) believes that this is a somewhat exaggerated statement. He estimates the amount at a quart to a quart and a half daily. "A three months child," says he, "generally thrives very well on four, or, at the most, five meals a day, the quantity taken each time amounting to a half-pint. This would fix the quantity at two pounds to two and a half, i. e., thirty-two to forty fluidounces. . . . A younger child, one to two months, may need to take his meals more frequently—it may be every two hours, except when asleep—but then the quantity consumed does not exceed, as a rule, as I have often ascertained myself, two wineglasses or three ounces every meal. This would raise the quantity taken in twenty-four hours to thirty-six ounces—a quart and a quarter. A child above three months may take about forty-eight ounces daily."

Dr. Cumming, in consequence of his high estimate of the amount of milk which an infant requires, naturally concludes that few mothers can long endure the excessive drain upon their systems, and therefore, in order to prevent their exhaustion, and to satisfy the appetite of their infants, it is necessary, at an early period, to aid by artificial feeding. This opinion may do harm, since artificial feeding of the young infant, especially in the cities, is apt to give rise to indigestion, followed by vomiting and diar-

rhoea. The mother in good health, and furnishing an average quantity of milk, is competent to give all the nutriment which the infant requires, until it has reached the age of four months, and most are, till the age of six months. Drs. Merri and Whitehead examined 953 mothers in the Children's Hospital at Manchester, in reference to their physical condition. Of these, 629, or 66 per cent., were in a healthy and robust state. Of this number, namely 629, 420 furnished sufficient milk till six months after delivery, and some till two years.

Differences in Suckling Women as regards Quantity and Quality of Milk.

There is, however, a great difference, in different women, as regards the quantity and quality of their milk, and even the mode in which it is secreted. The best wet-nurses are usually robust without being corpulent. Their appetite is good, and their breasts are distended from the number and large size of the bloodvessels and milk ducts. There is but a moderate amount of fat around the gland, and tortuous veins are observed passing over it. Such nurses do not experience a feeling of exhaustion, and do not suffer from lactation.

The nutriment which they consume is equally expended in their own sustenance and the supply of milk. There are other good wet-nurses who have the physical condition which I have described, but whose breasts are small. Still, the infant continues to nurse till it is satisfied, and it thrives. The milk is of good quality, and it appears to be secreted, mainly, during the time of suckling. Other mothers evidently decline in health during the time of lactation. They furnish milk of good quality and in abundance, and their infants thrive, but it is at their own expense. They themselves say, and with truth, that what they eat goes to milk. They become thinner and paler, are perhaps troubled with palpitation, and are easily exhausted. They often find it necessary to wean before the end of the usual period of lactation. There is another class whose health is habitually poor, but who furnish the usual quantity of milk without the exhaustion experienced by the class which I have just described. The milk of these women is of poor quality. It is abundant but watery. Their infants are pallid, having soft and flabby fibre. All these kinds of wet-nurses are met in practice.

Occasionally, a considerable part of the milk is lost by oozing from the breast. This sometimes occurs in robust women, but it is more frequently associated with weakness. It is then due to a relaxed state of the orifices of the milk ducts. Galactorrhœa, as the excessive secretion and flow of milk is designated, is said to be often associated with a menorrhagic diathesis; that is, women whose menses have been profuse are apt to have too abundant a flow of milk corresponding with the menorrhagia. It is said that galactorrhœa is also apt to occur in those who are subject to discharges from parts which sustain an immediate relation to the breast, as in cases of hæmorrhoidal flux, diabetes insipidus, etc. Excitement, or irritation of the uterus or ovaries, may serve as an exciting cause of galactorrhœa in those predisposed to it, and excessive suckling may have the same effect.

Scantiness of Milk; its Causes and Treatment.

Though the amount of breast milk which the infant requires is less than was estimated by Canning, still, insufficiency of this secretion, is not uncommon, especially in the cities. According to the statistics of Drs. Merel and Whithead, among healthy mothers there is insufficiency in 16.5 per cent., while among mothers in feeble health the percentage is 48.6. In treating of this subject in the following pages, reference is not had to those cases in which there is temporary diminution of milk from acute disease or other perturbing causes, but to those cases in which there is habitual scantiness.

One cause of scanty secretion of milk is a life of privation or of daily work, which necessitates separation from the infant. Insufficient food may render the milk more watery, as has already been stated, or it may cause diminution in its quantity. The mother thus situated is pallid. She is subject to palpitation and attacks of faintness. Her condition, indeed, is that of *anæmia*. Working women have scantiness of milk, not only in consequence of hardships, but also because they are usually separated, for hours, from their infants. Age is also a cause of scantiness of milk. Mothers at the age of forty years ordinarily furnish less milk than between twenty and thirty. And those who have not borne children till late in life, and whose mammary glands have there-

fore long been inactive, have less milk than those who commence bearing children at the usual period.

Routh speaks of hyperæmia as a cause of defective lactation. "This is a variety," says he, "which I have chiefly observed among hired wet nurses, selected from the poorer classes, and admitted into wealthier families. . . . When feeding at the expense of a master or mistress the amount they devour often surpasses all moderate imagination. They, in fact, gormandise. If in such instances a wet nurse is given all she asks for, she will be found often to eat quite as much as any two men with large appetites; and as a result, she becomes gross, turgid, often covered with blotches or pimples, and generally too plethoric to fulfil the duties of her position. The plethora, as first induced, is of the æthénic variety, but it soon assumes an æthénic character, and, as the immediate result, the breast no longer secretes its quantum of milk. There may be good milk secreted, but it is in small quantity, and this quantity diminishes daily. The breast may also enlarge, but it is from a deposition of fatty tissue in and about it, as in other parts of the body. The veins on the surface become less apparent, always a bad feature in a suckling breast, till finally the flow of milk ceases altogether."

Atrophy of the breast from the employment of boiling, or from long disease, is also a cause of insufficiency of milk.

It is so necessary for the health and development of the infant that the milk should be in proper quantity as well as quality, that it is proper in a work of this kind to consider the treatment of insufficient secretion, and, on the other hand, of excessive secretion and loss of milk, or galactorrhœa. And first of insufficient or scanty secretion.

The most efficient mode of increasing the lactal secretion is that which is also natural, namely, suction from the nipple. There are many cases on record in which this has produced the flow of milk in women who have never borne children, and even in men. Baudelocque mentions the case of a girl, eight years old, who suckled her brother for a month, and cases at the opposite extreme of life have been reported; one of a woman at seventy years, who wet-nursed a grandchild twenty years after her last confinement.

Travellers among barbarous nations or tribes have often observed these cases of unnatural lactation. Humboldt saw a man,

thirty-two years old, who gave the breast to his child for five months, and Captain Franklin, in the Arctic regions, met a similar case. Dr. Livingstone, in his account of Africa, says that he has examined several cases in which a grandchild has been suckled by a grandmother, and equally remarkable instances of lactation occur among the negroes of the Southern and Middle States. Prof. Hall presented to his class in Baltimore a male negro fifty-five years old who wet-nursed all the children of his mistress. In these cases of abnormal lactation, so far as we have complete records of them, it is ascertained that the breasts were torpid, and even sometimes, as in old people, atrophied till the nursing commenced. Tactitation, or pressing of the nipple, caused an afflux of blood to the gland, and developed its functional activity, so that milk was produced for the sustenance of the nursing. Therefore, in case of scanty secretion of milk, the mother may increase the quantity by applying the infant often to the breast. If dissatisfied with the small amount of nutriment which it receives, it refuses to make the necessary suction, any other mode of gentle traction or pressure may be employed in addition. The occasional employment of another infant, or a pup, milking the breast with the thumb and fingers, or the gentle suction of a breast pump, aids in stimulating the secretion. Forceful rubbing or traction of the breast defeats the purpose for which it is employed. It produces too much irritation and tenderness. The best mode of stimulation is by nursing, as it is the natural mode, and the moral effect of an infant at the breast aids in promoting the secretion.

Another mode of increasing the functional activity of the mammary glands is by electrical currents. The fact is established by physiological experiments, that glandular organs can be made to secrete more actively, by the stimulus of electricity, and accordingly, this agent has been successfully employed to promote the secretion of milk. In *Routh's Infant Feeding* several cases are related which show the beneficial effects of this agent (page 143 et seq.). Among them are six, reported by Dr. Skinner, of Liverpool. In all these cases, one or two applications of the electrical current sufficed to restore the secretion. The following is Dr. Skinner's mode of employing this treatment,

1. *Direct*.—Both poles must terminate in cylinders, with sponges well moistened in tepid water. The positive pole is

pressed deep into the axilla, while the negative is lightly applied to the nipple and the areola; the current being no stronger than is agreeable to the patient's feelings. The poles are kept in this position for about two minutes. Both poles are then to be inserted into the axilla, and gradually brought together, the negative to the sternal, and the positive to the opposite of the organ. This latter step may occupy one or two minutes more.

2. *Intramammary*.—The poles are to be, as it were, imbedded in the mamma, and moved about, raising and depressing both poles at once in and around the organ for the space of another two minutes. The same is to be done to both breasts daily, until the secretion is properly established. Hitherto one or two sittings have always sufficed in my hands." (*Communication of Dr. Skinner to Dr. Booth.*)

In all cases of scanty secretion of milk, the regimen of the mother is a matter of importance. Personal and domestic cleanliness are essential for successful wet nursing. A certain amount of exercise in the open air is conducive to the health of the mother, and to the secretion of abundant and healthy milk. A case is related to show the effect of fresh air and out-door exercise on the lactical secretion. A lady of cleanly habits, living in London, had a very scanty supply of milk. She removed to the pure air of the sea shore, and immediately the quantity became abundant, and continued so for months. Such cases are not unfrequent. A mode of life that contributes to the general health of the mother will not fail to augment the quantity of her milk, if it is scanty, and to improve its quality.

Much has been written in reference to the diet of women who suckle. It is a popular belief that certain articles of food promote the secretion of milk much more than other articles, though equally nutritious. No doubt, writers have erred in recommending exclusively this or that kind of food, as most likely to produce milk. The exact kind of food which is preferable, in a certain case, depends partly on the physique of the individual, and partly on the character of the food to which she has been accustomed. A mixed diet contributes most to the sustenance of the mother, and to an abundant secretion of milk. Animal substances which furnish a due supply of nitrogenous aliment, should be given with the farinaceous. Mothers pallid, and inclining to an anæmic condition, require a larger proportion of animal diet

than those in good general health. On the other hand, plethoric women, such as Bonth describes, who with excellent appetites consume large quantities of food, and who become more and more full blooded and corpulent while the milk diminishes, require a more restricted animal diet, in connection with more exercise, especially in the open air.

There are certain kinds of food which do appear to have a galactagogue effect with most wet-nurses. Oat-meal gruel is one of these. Wet-nurses often remark, after taking a bowl of this, that they feel the flow of milk. Cow's milk with some has a similar effect. Porter or ale taken once or twice a day also promotes the secretion of milk, especially in those who have poor appetite, and whose systems are somewhat reduced.

A great variety of medicines have been used for their supposed galactagogue effect. Medicines which improve the general health are, no doubt, sometimes useful for this purpose, such as the vegetable and ferruginous tonics, and perhaps cod-liver oil. But there are other medicines which it is claimed have a specific effect on the mammary gland, promoting its secretion. Lettuce, winter-green, fennel, the hrisoin tops (*cythous scoparius*) marsh-mallow, castor oil plant, and many other plants have been used for this purpose. There can be no doubt that the aromatic stimulants, as fennel, anise, and caraway seeds, given in soup, sometimes stimulate the lacteal secretion. But the medicine, which of late has attracted most attention in the profession, as a galactagogue, is castor oil and the plant from which it is derived.

The galactagogue effect of the leaves of the castor oil plant has been long known to the Spaniards in South America. At least as long ago as the commencement of the last century, the *ricinus communis* was applied by them externally to the breast, to promote the secretion of milk. It is now about twenty years since this use of the plant was brought prominently to the notice of the profession in this country and in Europe. In the *London Journal of Medicine*, 1857, Dr. Tyler Smith relates the results of his experiments with the castor oil plant. He applied the bruised leaves over the breasts, and witnessed, as he thinks, an evident galactagogue effect. Dr. Bonth has also made pretty extensive use of the plant, both externally and internally. He was led, he says, to employ it internally, from noticing, in suckling women, an increase of milk, after taking a dose of castor oil. He pre-

scribed a decoction of the leaves and stalks, and says: "I have not been disappointed. The flow has been remarkably increased. Four objections against its use, however, should be mentioned." These are, first, a peculiar sensation in the eyes, with dimness of sight, an effect which he has observed only in weak women; secondly, the necessity of increasing the dose as the patient becomes accustomed to it; thirdly, scarcity of the plant; fourthly, an occasional diuretic sometimes without galactagogue effect, and sometimes with it. The cases in which diuresis occurred were in the practice of other physicians, and Dr. Routh conjectures that this effect was produced by not keeping the breast warm during the time that the decoction was being employed. The breasts should at the time of its use be covered with a fomentation of leaves, or an extract of the leaves should be rubbed over the breasts in the same way in which extract of belladonna is used, and over this a warm poultice applied of the ordinary material. Dr. Routh remarks: "When the castor oil leaves are given as an infusion to women who are not suckling, I have observed two effects, both of which seem to denote its specific action. First, it produces internal pain in the breasts, which lasts for three or four days. Then, secondly, a copious lactoerhœal discharge takes place, after which the effect on the breasts entirely disappears."

Dr. Giffillan, of Brooklyn, has also employed the ricinus communis successfully, as a galactagogue. He employed a poultice of the pulverized leaves, and gave internally the fluid extract of the leaves, a teaspoonful three times daily. The patient had been confined the year before with her first child, but had no milk for it, though her health was good, and measures were employed, as friction and fomentations, to stimulate the secretion. The ricinus was prescribed the fourth day after her confinement with the second child, when there were no signs of secretion, and the breasts were small. "About two hours after the poultice was applied, and the first dose taken, she experienced a strange sensation in the breasts, and this increased after each dose of the medicine. The poultice was not renewed, but the extract was continued for three days, after which lactation was perfectly successful." So far observations have shown that the ricinus is the most efficient galactagogue which we possess among medicinal agents.

In the treatment of galactorrhœa the object to be attained

should be kept in view. There are medicines which cure this affection by diminishing the amount of milk. Belladonna, iodide of potassium, and oedobrium are antilactics. It is proper to use them in case of weaning or of death of the infant. They not only reduce the quantity of milk, but, continued, may prevent its secretion. They are employed not to benefit the infant, but the mother.

On the other hand, if it is our purpose to prevent the coming of milk in order to save it for the infant, or, if it is abundant and watery, to diminish somewhat its quantity and improve its quality, the treatment should be different. Iron, in cases of galactorrhœa, in which the condition of the system appears to indicate the need of it, will diminish the quantity of milk and render it richer. It is by many regarded as an antilactetic, and given long it might reduce too much the amount of the secretion, and even necessitate weaning. Its use should be discontinued if no more than the normal amount of milk is secreted.

In most cases of true galactorrhœa the pathological state is that of weakness and relaxation of the tissues. The fault is not excessive secretion of milk so much as its non-retention, and the medicines which are the most useful to correct this state of the system and of the breasts, are the vegetable tonics and astringents. If galactorrhœa occur in those who have an habitual discharge, and it appear to be due to the same cause which produces that discharge, and there are no evidences of weakness, laxative medicines and other derivatives may be employed. But such cases are not common. *Nux vomica* has been recommended in galactorrhœa in the belief that it diminishes the relaxation of the orifices of the lactiferous tubes.

Local treatment in this affection is important. A cloth wrung out of cold water should be occasionally applied around the nipple, and removed as it becomes warm. Solutions of tannin or alum are likewise useful. Collodion applied around the nipple, by its retraction, diminishes the orifices of the ducts, and thus aids in the retention of the milk.

CHAPTER V.

SELECTION OF A WET-NURSE.

IN the cities, cases are frequent in which mothers, with all possible care or endeavor, find themselves unable to suckle their infants. Their health is too poor, or the milk possesses the properties of colostrum, or it is no longer secreted on account of nervous excitement, or exhaustion, or inflammation of the breasts. The number of such cases, in the city, would surprise physicians who are familiar only with the healthy and robust mothers of the country. The infant thus deprived of the mother's milk should, if practicable, be furnished a wet-nurse.

The selection of a wet-nurse often devolves upon the physician, and it is a duty of great responsibility. It is better to select one between the ages of twenty and thirty years, and one who has suckled an infant previously. A wet-nurse between the ages of twenty and thirty is usually more active, cheerful, and conciliatory than one of a more advanced age, and her milk is more apt to be abundant and nutritious. Those who have previously suckled and had charge of infants are obviously more competent to serve as wet-nurses than are primiparae. The milk of a wet-nurse, whose infant is under the age of six months, will ordinarily agree with a new-born infant. If above that age, it sometimes agrees, but often does not.

The most difficult and responsible task imposed on the physician, in the selection of a nurse, is to ascertain the exact condition of her health, and the quantity and quality of her milk. Constitutional syphilis is common in the class of women who present themselves for wet-nursing; it is often latent, or its symptoms are easily concealed, and it is communicable by lactation. The virus may be received by the infant from fissures or excoriations of the nipple. The nursing tainted by syphilis may, on the other hand, communicate the disease to the nurse through the same source. It is not fully ascertained whether the syphilitic virus may be conveyed to the infant by the milk. But the cases which have been

mulated in the records of medicine are numerous, in which infants born of healthy parents have been fully syphilized by lactation from diseased nurses (see article Syphilis). These infants have sometimes led a short and miserable existence, and have occasionally increased the misery of the household by imparting the disease to others. The duty is, therefore, imperative on the part of the physician to examine carefully the wet-nurse, in reference to any evidence of the syphilitic taint. Acquainted with the symptoms of syphilis, he may usually, by shrewd questioning and by careful examination of the present appearance and condition of the woman, ascertain with considerable certainty whether her system has ever been infected. References should also be obtained and consulted, and, if practicable, the physician who has attended her be communicated with.

There are, also, among the women who present themselves for wet-nursing in the cities, many of a scrofulous habit, many who possess an hereditary tendency to tuberculosis, if indeed they do not already have the incipient disease. Such applicants should be rejected, on account of the poverty of their milk and the probability that they will not be able to endure the debilitating effect of lactation.

The milk should be examined in order to ascertain its richness and quantity, and whether it contains colostrum. If there is colostrum after the eighth day, it is probable that there is some fault in the health or digestion of the wet-nurse, and that her milk may disagree with the infant. It is not necessary that the breasts should be large, in order to furnish a sufficient quantity of milk, since, as has been already stated, in some the secretory function is active during the time of each nursing, so that, although the breasts are of moderate size, a sufficient amount of milk is furnished. The nipples should be well formed and prominent, and preference is to be given to those wet-nurses in whom vessels are seen ramifying over the breasts.

By examination of the milk, its degree of richness can be readily ascertained. A quantity of it should be placed in a test tube, and the cream, which rises to the top, indicates, approximately, the character of the milk. Good milk furnishes three per cent. of cream, and the caseum and sugar usually correspond in quantity with the cream. An instrument has been invented, called the lactometer, by which the exact amount of the cream

can be ascertained. It is simply a tube graded into 100 divisions. It is placed upright, and filled with milk, and the number of divisions occupied by the cream indicates its proportion in 100 parts. The lactoscope is another instrument employed for the purpose of ascertaining the richness of the milk. It consists of two concentric tubes, which move upon each other. Milk which we wish to examine is poured within the tubes sufficient to obscure a light viewed through it, three feet distant. The column of milk is then diminished, till the light begins to be visible. The size of the column indicates the degree of opacity and the richness. The lactoscope was invented by M. Donné, and is described by him.

Dr. Minchin recommends a simple mode of determining the richness of cow's milk, and it would equally answer for the breast milk. A vessel holding about one ounce, and containing a graduated enamel slab, passing diagonally from above downwards, is filled with milk. It is then covered with a glass slide carried over it in such a way as to exclude bubbles. The number of degrees which can be read, indicates the character of the milk, as regards its richness.

• Examination of the milk with the microscope not only enables us to determine whether there are abnormal corpuscles or granular elements, but also its richness. It should be examined before the cream has separated. Oil globules of small size, and few, indicate poverty of the milk; very large oil globules are said to indicate milk which is apt to be indigestible, especially in feeble infants. Such are the free globules of the colostrum. Numerous oil globules of medium size indicate nutritious milk. Vogel, in 1859, made the discovery of vibrios in human milk. The fact is established that these animalcules may be generated in the milk within the breast, though such cases are not frequent. Dr. Gibb describes a case which he met. (*Reeking's Abstract*, vol. xxxiv.) An infant, 7 weeks old, wet-nursed by its mother, who had the appearance of perfect health, was, nevertheless, ill-nourished and emaciated. It had no diarrhoea or other apparent disease, and the milk was therefore examined. Vibrios loculi were found in the milk immediately after it was obtained from the breast. The milk had the usual amount of cream, and seemed to the naked eye of good quality. According to Dr. Gibb, two genera of animalcules occur in the milk, namely, vibrios and

mooids. It is believed that the moulds occur in consequence of fermentation of the sugar and the production of lactic acid. Vogel also attributed the production of the vibriones to fermentation occurring in consequence of heat and congestion of the breast, connected with sexual excitement. This explanation is probably not correct, because vibriones sometimes occur when there is no unusual heat of breast, and no evidence of fermentation. The fact that such organisms may occur in milk which seems of good quality to the naked eye, affords additional proof of the usefulness of the microscope in the selection of a wet-nurse.

Many wet nurses have a return of the menses as early as the fourth or fifth month after delivery. The re-establishment of this function in some women impairs the quality of the milk, so as to render it less nutritious and perhaps less digestible; in other women it does not sensibly affect the character of the fluid or its quantity. In the selection of a wet-nurse, then, preference should be given to one who does not have the periodical sickness, but if she is already employed, and gives satisfaction, the reappearance of the catamenia does not indicate the need of a change of nurse, unless the digestion of the infant is disordered, or its nutrition is impaired.

In the selection of a wet-nurse attention should also be given to her mental and moral traits. Cheerfulness, affection, veracity, and a proper appreciation of the responsibility of her situation enhance greatly the value of a wet-nurse. Not less important are habits of temperance and cleanliness. I could cite cases of the most melancholy results from the absence of these traits. In one case illness resulted from an infant falling upon the pavement from the arms of a reckless or intemperate wet-nurse.

In most cases the mode of examination indicated above suffices to show the character of a wet-nurse, so far as her health and milk are concerned. It should be borne in mind, however, that the microscope does not always reveal deleterious properties in the milk. Elements which are in a state of solution, and are invisible, may occur in excess, so as to impair the quality of the milk, and render it indigestible. The following case, in which the saline ingredients seem to have been in excess, is related by Dr. Hartmann (*British and Foreign Medical Review*, vol. xii.): "An infant whose mother was in good health, and had borne several children, exhibited a healthy appearance for the first five

weeks after birth. The alvine evacuations then became copious, fluid, and discolored, and the child lost flesh and strength. After the usual remedies had been vainly administered for a fortnight, the mother remarked that the child did not take the right breast willingly, and so much did the unwillingness increase, that at length the mere application of the nipple to the child's lips occasioned loud crying. On examination it was found that the milk of the right breast had a distinctly saline taste; whereas the milk of the opposite breast was of the ordinary sweetness; no difference of consistence or color was discoverable. From that time the child was only allowed to nurse the left breast, and in a few days all diarrhoea and sickness of appearance vanished." In this case there was no appreciable disease of the breast, although its secretion was perverted. The deleterious character of the milk was discovered, not by any change in its appearance, but by the taste.

CHAPTER VI.

COURSE OF LACTATION—WEANING.

REGULARITY in nursing is required. The young infant in whom the milk is rapidly assimilated, may take the breast every two hours in the day, and two or three times in the night. Still, as M. Donné has said, mathematical exactness in this matter would be ridiculous. Quiet, natural sleep of a well-nourished infant should not be interrupted in order to give it the breast, unless the sleep be unusually protracted. It will usually awaken when the system requires more nutriment. Ill-nourished infants, according to my observations, sleep but little until they become much prostrated, when they are drowsy, in consequence of passive congestion of the brain. This drowsiness is evidently a pathological symptom. It shows the need of increased nutrition. It is due to scantiness of milk, or milk of poor quality, and the infant should be aroused frequently for the purpose of giving it nutriment or even stimulants.

As the infant grows older the stomach receives a larger amount

of milk, and it should nurse less frequently. The breast milk is sufficient for its nutrition till the age of six or eight months, provided it is abundant and of good quality. If the mother is strong and experiences no exhaustion from suckling, the infant therefore need receive no other nutriment till that age, or indeed till the age of ten or twelve months.

Many mothers, however, by the third or fourth month of lactation, find that they have not sufficient milk to meet the wants of the infant. The constant drain upon their systems sensibly impairs their health. In such cases it is proper to commence with a little feeding from the spoon or bottle, and increase the quantity given as the infant grows older. Great care is, however, requisite in the preparation of food for so young an infant, whose digestive organs are still feeble and easily deranged. In the country, where diarrhoeal affections and the so-called gastric derangements are not frequent, the danger from artificial feeding is less than in the city, and, in the cool months in the city, the danger is less than in the summer season. Infants of the city, between the months of May and October, have a strong predisposition to diarrhoeal attacks, the result of anti-hygienic influences which surround them. Errors of diet in their case readily provoke disease or derangement of the digestive organs, often of a severe and dangerous form. Moreover, experience has shown that these infants, if fed with the bottle, however carefully, during the period when nature designed that they should be nourished by lactation, very commonly are affected in the hot months with more or less vomiting and diarrhoea, followed by emaciation and other evidences of mal-nutrition. Therefore, an exception must be made in case of the city infant as regards the commencement of artificial feeding. If it is under the age of one year, it should be nourished exclusively, or almost exclusively, at the breast during the hot months, when practicable, even if the mother suffers somewhat in her health from the constant drain upon her system. The infant should, however, receive the amount of nutriment which it requires, and, if there is not sufficient breast milk, it will be necessary to supply the deficiency by artificial feeding.

The subject of artificial feeding will engage our attention in a separate chapter. It suffices, therefore, in this connection to state that nursing infants of three or four months may begin to take a

little cow's milk, carefully prepared, and of the best quality. It should be diluted; but the amount of dilution required obviously depends on the richness of the milk. Rich country milk is sufficiently diluted, if the infant is in good health, by adding half its quantity of water, while most samples of milk furnished in the city do not require more than one-third their quantity of water.

A little sugar of milk, which is slowly soluble, should be dissolved in the water before its mixture with the milk. One drachm of the sugar is sufficient for five or six ounces of the milk, and to the same quantity, if the stools are at all acid, two teaspoonfuls of lime-water should be added. It is proper, also, to allow farinaceous food to an infant of three or four months, if its digestive organs are in good condition. I prefer barley flour for this purpose to arrowroot, rice, or wheat flour. Barley-water should be prepared from Robinson's or some other flour of good quality, and mixed while still warm with an equal quantity of milk, and the sugar of milk added. The barley-water should be of about the consistence of milk, and prepared in the usual way by boiling. The milk should not be boiled. It may, indeed, be stated, as a rule, that it is not advisable to boil milk designed for infants, except in the city, where it may be boiled in order to its better preservation. Toast-water may be also employed for diluting the milk, but it is less nutritious than barley-water.

As the infant grows older, semi-liquid food may be given. After the age of six months pop prepared with stale bread, or a rolled soda cracker, may be given, once or twice daily, between the times of nursing, and occasionally beef-tea or chicken broth, thickened with cracker or bread, is taken with relish, and if well prepared, and given no oftener than once or twice a day, it is commonly readily digested, while it is highly nutritious. If the quantity of breast milk diminishes, as it often does, towards the close of the first year, artificial food should be given oftener, so as to supply the deficiency. Solid food requires considerable development of the digestive organs for its ready assimilation. It should not, therefore, be given till the close, or near the close, of the first year.

Weaning ought to take place, as a rule, between the ages of twelve and eighteen months. It is well, if the mother's health is good and her milk is sufficient, to defer weaning till the canine teeth appear. The infant, then, possessing sixteen teeth, is able to

nourish the softer kinds of solid food. Weaning should be gradual. Mothers often speak of weaning on a certain day. They have given but little artificial food, and have suckled at regular intervals till at a fixed time they have deuced the breast altogether. This abrupt change of diet should be discouraged. It should only be recommended under peculiar circumstances. It is apt to derange the digestive organs, and it causes fretfulness and sleeplessness on the part of the infant, for a week or more. Weaning should commence by feeding with the spoon, a little oftener through the day, and nursing less, and by discontinuing the practice of suckling at night. The infant tolerates this gradual change of diet, while it rebels against sudden weaning, and by its fretfulness increases greatly the care and trouble of the mother. The infant in the city should not be weaned in warm weather, nor within a month immediately preceding it. If the mother's health fails, or her milk becomes deficient, in the summer months, so that she cannot continue suckling, the infant should be sent immediately to the country, or a wet-nurse be employed. Many infants are sacrificed in consequence of ignorance of the danger of weaning under the circumstances mentioned. Severe diarrhoea, inflammatory or non-inflammatory, is apt to result. This subject will be considered elsewhere.

CHAPTER VII.

ARTIFICIAL FEEDING.

OCCASIONALLY the mother is unable to suckle her infant, and a hired wet-nurse cannot be or is not obtained. Artificial feeding is then necessary. In the large cities, if I may judge from our New York experience, this mode of alimentation for young infants should always be discouraged. It generally ends in death, preceded by evidences of faulty nutrition. A considerable proportion of those nourished in this manner thrive during the cool months, but on the approach of the warm season, they are the first to be affected with diarrhoea and other symptoms indicating derangement of the digestive function. In my opinion, based on

a pretty extended observation, more than half of the New York spoon-fed infants, who enter the summer months, die before the return of cool weather, unless saved by removal to the country. In the country and in the small inland cities, the result of artificial feeding is much more favorable. The majority live, and in elevated farming sections, on account of the salubrity of the air, and the facility with which milk, fresh and of the best quality, is obtained, artificial feeding appears to be nearly as favorable as wet-nursing.

Young infants, fed by the hand, obviously require food prepared so as to resemble as closely as possible the human milk. The basis of such food must, therefore, be the milk of some animal. The following table, prepared by MM. Vernot and Becquerel, gives the proportion of the ingredients of human milk, and the milk of the four domestic animals which is most easily obtained and most frequently employed as food.

Composition of Milk.

	Specific gravity.	100 parts contain—		The 1000 components contain (H. M.)			
		Field.	Stable.	Sugar.	Butter.	Casein and extract of whey.	Salts.
Man.	1002.67	860.98	138.92	43.64	26.66	39.34	1.38
Cow.	1002.38	864.98	135.94	38.03	26.72	35.12	6.84
Ass.	1034.57	890.32	168.88	34.46	18.32	32.65	5.24
Goat.	1002.55	844.38	155.10	38.91	56.82	33.14	6.18
Ewe.	1049.96	822.22	167.68	39.43	54.21	63.78	7.16

Cow's milk is most readily obtained and is commonly used as a substitute for human milk, compared with which it contains less water and sugar, but more butter, casein, and salts. Its composition, however, varies considerably according to the food of the cow and other circumstances. The variations in the milk of the cow, according to the nature of its food, have been considered in a preceding chapter. It has been stated, also, that the milk first obtained in milking is most watery, since it is longer secreted than the last milk, or the "stripping." The stall-fed cow gives acid milk, while the cow grazing in a pasture gives milk that is alkaline. Again, the milk in the first months after calving is richer than after the lapse of several months.

It is obvious from the above facts that the analysis of different

specimens of cow's milk must differ greatly, and the same is true of the milk of the goat and ass, and probably of the ewe. In fact, different samples of the milk of the same animal may differ more from each other, in their chemical character, than the average milk of one animal from that of another.

The milk of the goat and that of the ass have been recommended as food for infants in preference to cow's milk, on the ground, as is alleged, that they more nearly resemble human milk. But by reference to the foregoing table it will be seen that more importance has been attached to this supposed resemblance than the facts justified. Neither the milk of the ass nor goat, so far as its chemical character is concerned, would seem to possess any advantages over cow's milk. The ass's milk is procured with difficulty, and is seldom used. An objection to goat's milk is the unpleasant odor which it often possesses, due to the presence of lincic acid. It is stated, however, by Pamiéntier that this odor is only noticed in the milk of goats that have horns. An important advantage, in the only, in the use of goat's milk, is that the animal can be kept at little expense, so that even poor families who are not able to purchase and feed a cow can generally possess a goat, from which fresh milk can be obtained at any time. Preference is to be given to goat's milk when fresh, over cow's milk brought from the country, perhaps watered on the way, and several hours old when received. If, however, as both chemical analysis and experience show, goat's milk is no better as food for infants than cow's milk when fresh and from healthy cows, the latter must continue in common use for this purpose.

For infants under the age of three months, cow's milk of ordinary richness should be diluted with an equal quantity of water or thin barley-water. M. Deane prefers the first milking when it is possible to obtain it. This, containing a smaller proportion of solid elements than the average milk, bears a closer resemblance in its chemical character to human milk, and requires but little dilution. Occasionally young infants fed in this manner have green and acid stools, accompanied with vomiting and emaciation, showing indigestion and disagreement of the milk. Perhaps the milk is given too frequently, or it may require more dilution, but if after these changes are made symptoms of indigestion continue, milk containing an excess of cream may be employed. This is best prepared as follows: milk, as fresh as possible, is allowed to stand

two or three hours, and the upper third of it then removed for use. To one part of this two, or even three, parts of warm water or barley-water, holding a little sugar or milk in solution, should be added. If still symptoms of indigestion are present, milk should be prepared according to one of the formulæ given in Appendix A.

At the age of four months the artificially fed infant may be allowed pop made with a crushed soda cracker or stale bread, upon which boiling water is poured and then drained off, and afterwards milk added. Porridge made with rice flour, barley flour or arrowroot, and milk, may also be allowed at this age. At the age of five or six months, beef-tea, to which crumbled soda cracker or stale bread is added, is a suitable and nutritious food. After the age of six months various kinds of solid food which are easily digested may be allowed, but the infant should not have the ordinary and full table diet of adults till after the age of two years. The reader is referred to Appendix A. for various dietary formulæ and directions relating to the choice and preparation of food, which will be found useful in the treatment of young children, especially in diseases in which the digestive function is seriously impaired.

CHAPTER VIII.

DIAGNOSIS OF INFANTILE DISEASES.

General Observations.

Diseases in early life differ in important particulars from those occurring in maturity. Some which are common in the former age are unknown or are rare in the latter, and those which occur equally at all ages often present peculiar symptoms, and a peculiar clinical history in the young. Therefore physicians who are skilful in treating adults, may be unskilful in treating children. Excellence as a physician of children can only be achieved by special and continued study of their ailments.

Again, as regards the diseases of infancy, in which period there is a great amount of sickness and a large mortality, diagnosis

must evidently be made from the objective symptoms; from examining the features, attitude, utterances, the pulse, respiration, etc., and inspecting the surfaces, so far as they are accessible to view, and the eliminative products. We lack for this age the important information which speech affords. Some general remarks, therefore, in reference to the appearances and functions of the system in early life, and the changes which they undergo in various pathological states, seem requisite, in order to a clearer appreciation of the symptoms, and more ready diagnosis of individual diseases.

Features. External Appearance of Head, Trunk, and Limbs in Disease.

In the new-born, as soon as respiration and the new circulation are established, the cutaneous capillaries become distended with blood, and the skin presents a congested appearance. By the close of the first week this external hyperæmia begins to abate, and is soon replaced by the normal capillary circulation.

Icterus is common in the first and second week. Bonetus attributes it to mild hepatitis. A much more plausible view of its causation, and probably the correct one, is that of Frerichs, who attributes it to the effect on the hepatic circulation of ligation of the umbilical cord. By ligation the current of blood through the umbilical vein to the liver ceases, the amount of blood in the hepatic capillaries, which connect with the branches of the vena diminishes, and then, according to Frerichs, diversion occurs of a part of the bile from the hepatic cells into the capillaries, while the rest flows in the normal manner in the bile-ducts. The degree of jaundice is proportionate to the amount of bile which enters the circulation. Icterus neonatorum is not a disease of importance. It subsides without medicine in the course of one or two weeks, when the circulation through the liver becomes equalized and regular.

The surface, or portions of the surface of the new-born, often present for a few hours a livid color due to the mode of delivery. Protracted lividity occurs from atelectasis or malformation in the heart or great vessels; lividity induced by exertion or excitement while the respiration is normal, indicates malformation of the heart or vessels; temporary lividity sometimes occurs in severe acute diseases, especially those of the respiratory organs;

lidity, whether temporary or permanent, is a sign of imperfect decarbonization of the blood.

The cheeks of children are congested in febrile and inflammatory diseases, except in cachectic or prostrated state of system. Transient circumscribed congestion of the face, ears, or forehead constitutes a reliable sign of cerebral disease. Strabismus occurring in connection with febrile reaction, oscillation of iris, inequality of pupils, and drooping of upper eyelids also denote cerebral disease. The pupils are contracted during sleep; evenly dilated in death.

Dilation of the *alae nasi* during inspiration with contraction of the eyelids, and a countenance indicative of suffering attends severe inflammation of the respiratory organs. Absence of tears during the act of crying shows a severe, and probably fatal form of disease in infants over the age of four months.

Rapid wasting of the features, causing deep suborbital depressions, prominences, and pointedness of the cheek-bones and chin, and hollowness of the cheeks are signs of a severe diarrhoeal affection; the most striking examples of this sudden collapse of features are afforded by patients affected with cholera infantum. In severe cases of this disease, the physiognomy from a state of fulness and health presents in a few hours such a wasted and senile appearance that the friends with difficulty recognize the features with which they are familiar. Muscular tonicity is also impaired, that of the orbicular muscles of the lips and eyelids to such an extent that the mouth is open and eyelids exposed during sleep. Great emaciation of features occurring gradually is a result of subacute or chronic disease of a grave character, often of tuberculosis or chronic entero-colitis.

Strabismus sometimes occurs in children whose health is not impaired. It is then due to simple paralysis of one or more of the motor muscles of the eye. A permanently downward direction of the axes of the eyes, with smallness of the face, and great expansion of the cranium, is a sign of congenital hydrocephalus. The scalp in this disease is tense, bald, or sparingly covered with hair, the fontanelles and sutures open and enlarged, and the cranial bones yielding to pressure.

The appearance of the general cutaneous surface possesses much greater diagnostic value in the diseases of infancy and childhood than in those of adult life. The eruptive fevers

which are so common in the young, reveal themselves to us mainly by the changes which they cause in the appearance of the integument. In the infant the cold stage of intermittent fever is manifested, not by muscular tremors, but by lividity, pallor, and the goose-skin appearance of the surface.

Bulvous enlargement of the fingers and incurvation of the nails, are signs of pyretic ozymosis, and therefore of malformation at the centre of the circulatory apparatus. Enlargement of the spongy portions of bones, causing proeminentes, softness, and bending of the bones, and consequent deformity of the limbs, patency of the fontanelles, a large and square shape of the head from calcareous deposit external to the cranium, are among the signs of rachitis.

In early infancy the glands of the skin and mucous surfaces, or which connect by their orifices with these surfaces, are slightly developed. Therefore sensible perspiration and lachrymation are rare under the age of three months. A thick Meibomian secretion of a puriform appearance collecting between the eyelids, is an unfavorable prognostic sign; it indicates a state of great depression; it is observed most frequently in cerebral and intestinal affections a little before death. Passive congestion of the vessels of the conjunctiva sometimes occurs under the same circumstances; it is a sign of feebleness of the heart's action, and imperfect capillary circulation.

Attitude—Movements—the Cry.

A sharp, piercing cry, head firmly retracted, flexure of the limbs with a degree of rigidity, adduction of the great toe, clonic or tonic spasm of the muscles, irregular movements of one or more limbs with consciousness impaired, or with mental hallucinations, are symptoms of grave disease of the cerebro-spinal system. Irregular muscular movements partly controlled by the will, and occurring during full consciousness, are symptoms of chorea, a disease nearly always ending favorably in children, though insurable in the adult. Contraction of the eyebrows, turning of the eyes and face from light, avoidance of noises, as if painful, are signs of headache. Frequent carrying of the hand to the ear and pressing with the ear against the breast of the mother or nurse, are symptoms of otalgia. Frequent carrying of

the fingers to the mouth and pressing on the gums may be due to difficult dentition.

In severe obstructive diseases of the larynx, the child is restless, moving from side to side. In most inflammatory diseases of the respiratory organs, a semi-erect position gives most relief. The cry in laryngitis is hoarse or indistinct; in pleuritis or pneumonia it is restrained and abrupt, since the movements of the walls of the chest give pain.

The cry in acute diseases of the abdominal organs is not so shrill as in those of the brain, nor commonly abrupt as in those of the respiratory organs; it may be a protracted and low moan, if the movements of the diaphragm are painful; the voice in abdominal diseases is in some cases free, and in others restrained and short, as in pleuritis and pneumonia. The latter character of the voice is observed in acute dyspepsia, in peritonitis, and in cases of great abdominal distension. The horizontal position gives most relief in abdominal diseases; pressing the hand upon the abdomen, and flexing the thighs over it, are signs of abdominal pain, especially if the features at the same time are indicative of suffering. Perfect quietude, with features sunken, and unchanged by smile or crying, is a symptom of severe and exhausting diarrhoeal affections.

Respiratory System.

The respiration of the infant under the age of six months is very irregular, and it is more irregular the nearer the time to birth. If the new-born infant is closely observed, it will be seen to sigh often: it breathes pretty uniformly and regularly for a moment, and then, without appreciable cause, the respiration is intermitted; it holds its breath when it smiles or moves its head, or even its limbs; it is very subject to hiccup: this is more common the first week of life than at any other age. So much is the breathing of the young infant disturbed by these causes, that the number of respirations ordinarily varies in consecutive minutes. In order, therefore, to determine with accuracy the frequency of the normal respiration, for this time of life, it is necessary to take the average of several observations.

At birth, while the function of the heart has, for months, been regularly performed, the lungs are still quiescent. The *one* organ

has been active during the greater part of fetal development, the other is yet untried. Hereafter, in the new order of things, so intimate is the relation between the heart and lungs, that the proper performance of the function of one is essential to that of the other. Therefore the commencement of respiration and the return of circulation, which is modified and temporarily arrested at birth, are nearly simultaneous. Respiration commences in the first half-minute of independent existence; often, indeed, attempts to inspire occur before the delivery is completed. The exceptions to this early establishment of respiration are, after tedious or unnatural births. The return of circulation is a moment later.

RESPIRATION IN HEALTH.—As the air cells at birth are closed, the establishment of respiration is difficult. The air at first penetrates a few pulmonary cells, but gradually more and more are inflated through the forcible inspirations which the crying of the infant produces, till after a variable time respiration becomes easy and complete. If the cry is feeble, and especially if with this feebleness there is considerable congestion of the brain, the result of tedious birth, the full establishment of respiration is in a corresponding degree gradual and slow.

The frequency of the respiration in health should be ascertained, in order to determine whether, in a given case, it is abnormally accelerated. The following table embodies the result of observations which I have made, in order to determine the normal frequency of respiration in the first year of life.

Normal Infantile Respiration (number per minute).

	AGE.										
	First half hour.	From first half hour to close of first week.		From close of first week to close of first month.		From close of first month to close of third month.		From close of third month to close of sixth month.		From close of sixth month to close of first year.	
		Arith.	Geom.	Arith.	Geom.	Arith.	Geom.	Arith.	Geom.	Arith.	Geom.
Number of observations.	25	35	14	15	11	14	20	24	7	15	6
Extreme variation of respiration for particular age.	25-45	22-38	25-35	25-35	25-35	25-35	25-35	25-35	25-35	25-35	25-35
Mean quotient of respiration per minute.	40.5	31	33	33	32	32	31	30	34	31	39

As the child advances from the age of one year, the number of respirations per minute gradually diminishes; but through the whole period of childhood it remains greater than in the adult. At the age of five years, when the child is quiet, but awake, it is about 27; at the age of ten years, about 22.

RESPIRATION IN DISEASE.—In cerebral diseases the respiration is apt to be slow, and if somnolences occur, intermittent, and accompanied by sighing. In young infants, in the drowsiness which supervenes when the blood is imperfectly decarbonized, in severe attacks of capillary bronchitis, or broncho-pneumonitis, respiration is apt to be intermittent.

In inflammatory diseases of the larynx and trachea, respiration is but slightly accelerated, and, if there is no obstruction, its rhythm is normal; if there is obstructive disease, its rhythm is altered; the inspiratory act is lengthened. In bronchitis, respiration is accelerated in proportion to the degree of extension downward of the inflammation. It is in no disease more accelerated than in severe capillary bronchitis.

In pleuritis and pneumonitis, the respiration is accelerated in proportion to the extent and acuteness of the inflammation. Inspiration ending abruptly, and succeeded by an expiratory moan, is a symptom of both pleuritis and pneumonitis in their acute stages. In certain cases of irritative or inflammatory disease of the abdominal organs, respiration presents a similar character; it is modified in this manner in consequence of the pain experienced in movements of the diaphragm. Ordinarily, however, in abdominal diseases, respiration is nearly natural.

The cough is often an important diagnostic symptom. It is loud and sonorous in spasmodic croup; hoarse or harsh in true croup; clear or distinct in bronchitis; suppressed and painful in the early stages of pneumonitis and pleuritis; convulsive, and with more inspirations than expirations, in pertussis. A cough is one of the first and most constant symptoms of measles; it is due to coexisting bronchitis. Typhoid and remittent fevers, difficult dentition, intestinal worms, irritating ingesta, and severe burns, sometimes give rise to a cough, which is nearly dry and painless. Occurring in such diseases, it is sometimes dependent on more or less bronchitis, to which the primary disease has given rise.

Circulatory System.

In all ages and countries the pulse has been considered an important symptom both in diagnosis and prognosis. It aids the practitioner in determining, approximatively, not only the character, but gravity of diseases. It is somewhat remarkable, from the importance which is attached to the pulse in medical practice, that its normal frequency and its character, in infancy, are not more accurately known. It is true that eminent observers, as Trousseau and Valleix, have published statistics relating to the infantile pulse in health, but these statistics disagree, and therefore do not afford a reliable standard with which to compare the pulse in disease. Moreover, some published statistics of the pulse possess but little value, from the small number of observations; some from the fact that records of the infantile pulse are grouped with those of older children, and others because the state of the infant, as regards its activity or emotions, is not mentioned.

PULSE IN HEALTH.—It is not easy to collect statistics of the healthy pulse for the period of infancy, which are entirely free from error, since there are often slight derangements of the system in the infant, which are not manifested by any marked symptoms, but which produce acceleration of the pulse. In collecting the following statistics, it was my endeavor to avoid sources of error so far as possible.

In ordinary cases the movements of the heart begin about one-eighth of a minute after birth. They are at first slow, the ventricular contractions not numbering more than eight or ten by the close of the first quarter-minute. In the second quarter the cries are vigorous, and the pulse now is rapidly accelerated, rising commonly above 120, and sometimes above 180 beats per minute. In fifty-seven observations of the pulse in healthy infants during the first half hour of life, after the first quarter of a minute, I found that the extremes, with one exception, were 104 and 184—average 132.

Table of Infants Pulse in Health.

AGE.

	First week.		From time of first week to close of first month.		From time of first month to close of third.		From time of third month to close of sixth.		From time of sixth month to close of first year.	
	When Quiet, moving slightly, waking.	Asleep.	When Quiet, moving slightly, waking.	Asleep.	When Quiet, moving slightly, waking.	Asleep.	When Quiet, moving slightly, waking.	Asleep.	When Quiet, moving slightly, waking.	Asleep.
Sex of child.	22	24	30	32	41	47	51	5	55	1
Extremes.	116-132	100-140	124-136	104-144	112-140	90-132	112-144	104-136	112-144	
Mean.	120	122	128	128	132	118	122	120	127	100

"M. Ledebender," says Bouchut, "could only count the pulse in the first minute of life in six children, and he has observed from 72 to 94 pulsations." Valleix estimates the pulse, between the ages of two and twenty-one days, at 87. Trousseau states that the pulse, in the first week of life, varies from 78 to 150; and Dr. Gorlaui's observations are somewhat similar to Trousseau's. My observations, as seen from the above table, do not correspond with the assertions of Ledebender and Valleix. Indeed, if there were no conflicting testimony there would still be a strong presumption that these authors are in error, for we would not suppose that the pulse of the infant, in whom there is greater functional activity, both muscular and visceral, would fall so much below that of the fœtus. It is probable from the expression, "could only count the pulse . . . in six children," that Ledebender and perhaps Valleix counted the pulse at the wrist, which, with exceptional cases, is very difficult and often impossible in the first week of life, and that they missed some of the beats, or, not unlikely, sometimes counted their own pulse. Immediately after birth there is so little force of the ventricular systole, and the extreme arteries, therefore, of the system pulsate so feebly, that neither in the limbs nor at the anterior fontanelle can the frequency of the pulse be readily ascertained. It can be readily and accurately ascertained only by auscultation, or by placing the hand on the precardial region, or directly after birth by the pulsations in the umbilical cord.

The average pulse of the healthy infant in the first and second months is, according to Trousseau, 137 per minute, 128 from the

third to the sixth month, and 120 from the sixth to the twelfth month. It is seen that his observations agree closely with mine, as regards infants who are quiet but awake. One point of interest, established by the above statistics, is the great diminution in the frequency of the pulse in sleep.

Pulse during or after Active Movements, or Great Mental Excitement.

AGE.

	First week.	Close of first week to close of first month.	Close of first to close of third month.	Close of third to close of sixth month.	Close of sixth month to close of first year.
	140	162	176	133	132
	160	158	152	148	144
	140	149	158	148	132
	152	159	141	141	139
			152	156	138
			180	156	190
Extremes.	130-160	146-162	144-180	133-156	132-156
Mean.	148	152	160	147	136

It is seen, by the above table, that by active exercise or great mental excitement, the pulse may become as rapid as in grave disease. There is greater acceleration of pulse from the emotions and from exercise in feeble than in robust children. Obviously, in order to determine to what extent the pulse is accelerated in disease, it is necessary that it should be counted during a state of quietude. As the age increases, it is less and less influenced by the emotions and physical exertion; still, during the whole period of childhood, such influences do have more or less effect on its frequency.

PULSE IN DISEASE.—Febrile and inflammatory diseases, produce greater acceleration of pulse in early life than in maturity. Diseases, or derangements of system, particularly those of the digestive organs, which do not materially affect the pulse in the adult, often cause acceleration of it in children. The febrile pulse of early life usually has exacerbations in its frequency. These commonly occur in the latter part of the day. Distinct and more or less regular febrile exacerbations and remissions are common in several diseases of early life, some of which are serious, while others involve little danger. Among these diseases may be men-

glued difficult dentition, intestinal worms, incipient meningitis, and constipation. Intermittence of the pulse is a symptom of great gravity; in children it is a sign of an organic disease of the brain or meninges.

Animal Heat.

The internal temperature of the body in a state of health is uniform. In 33 infants under the age of seven days, M. Roger found the average temperature $98^{\circ}.6$ Fahr., while in 25 from four months to fourteen years old it was 99° . The external temperature alone varies in a state of health, according to the temperature of the atmosphere.

Elevation of temperature above the normal standard is a sign of inflammatory and febrile affections. The increase of heat varies according to the character of the disease and its type. In favorable cases of inflammation and in simple fevers it is not ordinarily more than two or three degrees. The greater the severity and malignancy of inflammatory and febrile diseases, the greater the elevation. An elevation of more than six degrees indicates a form of disease which is likely to prove fatal. It is rare that the temperature, even in fatal cases, rises above 107° . In measles the temperature in the eruptive stage is from 101° to 103° ; in scarlatina from 102° to 104° , if no complication exist.

Reduction of the internal temperature is an unfavorable prognostic sign; it is observed, a few hours before death, in infants who are greatly reduced by certain chronic diseases, as enterocolitis. In these cases the tongue and even sometimes the breath communicates to the finger or hand a sensation of coldness.

Digestive System.

Inspection of the buccal and faucial surfaces discloses some of the most frequent local diseases of infancy, as the various forms of stomatitis, and others which, though not frequent, involve great danger, as gangrene of the mouth, diphtheria, and retro-pharyngeal abscess. Inspection of the tongue aids in determining in many cases whether the disease is pursuing a favorable course, or has become septic, and is exhausting the vital powers.

Follicle movements, even when slight, give rise to coating of the tongue, and insensescence and distinctness of its follicles. The eruptive fevers are attended by changes upon the buccal and facial surfaces which possess great diagnostic and sometimes prognostic value. Scarlet fever is more severe and more apt to be fatal when attended by great angina.

Inspection of the buccal and facial surfaces sometimes enables us to form a probable opinion in reference to the nature of diseases which are seated in other parts. A pseudo-membrane on the facial surface, in connection with symptoms of obstructive laryngitis, is a sign of fibrinous exudation in the larynx; though not positive proof. In the infant protracted stomatitis is a common accompaniment of chronic diarrhoea, and it indicates its inflammatory nature.

Vomiting is more frequent in infancy than in childhood, and in either period than in the adult. It is common in cerebral affections; its presence in meningitis often aids in establishing a diagnosis which would otherwise be obscure. Vomiting is one of the first symptoms of scarlet fever, and it is not uncommon, though less frequent, in the commencement of the other essential fevers and of acute inflammations. It is a symptom of indigestion, enterocolitis, cholera infantum, and intussusception; it is common, also, after the paroxysmal cough of pertussis, and not infrequent in the bronchial inflammations of young infants; in both which diseases it is excited by the mucus upon the facial surface.

Intestinal gas is in part secreted or exhaled from the mucous membrane, as the experiments of Hunter and others have shown, and it is in part the product of chemical changes in the food. A certain amount of gas in the intestines is normal; it subserves a useful purpose. An abnormal amount of it is common in various diseases, as indigestion, chronic enterocolitis, peritonitis, typhoid fever. It is a frequent cause of gastralgia and enteralgia in the infant. In scrofulous or feeble infants, with impaired muscular tonicity and faulty digestion, the abdomen is often habitually more or less distended with gas which does not, under such circumstances, give rise to pain or other local symptoms; it has significance in showing the general condition of the child.

Retraction of the abdomen is common in meningitis and in many exhausting diseases. Tenderness of abdomen, so common

and important a symptom of intestinal inflammation in the adult and in childhood, is absent or not appreciable in the enterocolitis of infancy. Tenismus is a symptom of colitis, or of intussusception in the infant.

Much light is thrown on the character of intestinal diseases by the appearance of the stools. Mucosanguineous stools accompanied by fever are a sign of colitis. Stools containing unmixed blood, and not accompanied by fever, may result from a rectal polypus. Scanty evacuations of blood with obstinate constipation, are a symptom of intussusception in infants.

The alvine discharges of infants often present a green color; sometimes they have the normal yellow hue when passed from the bowels, but become green on exposure to the air, or from reaction of the urine. By the microscope the green coloring matter is seen to occur in small irregular masses. This green substance has been supposed to be bile. I have satisfied myself that, as met in the stools of the infant, it is commonly produced by the action of the intestinal secretions on the contents of the intestines; perhaps the action is upon the bile which is mingled with the contents. I have often noticed the contents in and above the jejunum yellow, while in and below the ileum, the color was green.

The green hue may occur from very different causes. It may be due to overfeeding, to the action of cold, to irritating ingesta, to inflammation, etc.; it may be transient, subsiding within a day or two, or it may continue several days. All infants, at times, have green evacuations, even when they appear to be in good health.

The alvine discharges of infants, in a large proportion of cases of diarrhoeal affections, give an acid reaction with litmus paper. This acid, if in considerable quantity, is irritating, increasing the peristaltic movements of the intestines, and the functional activity of the intestinal follicles, causing erythema of the skin around the anus, and reacting upon, and intensifying the intestinal disease. Hence the indication for the use of antacids, in the diarrhoeal affections of infancy.

The presence of intestinal worms and the species, may be ascertained by microscopic examination of the stools of the child who is affected with these entozoa. The stools contain ova, which differ in size and shape according to the species of worms.

PART II.

SECTION I.

DISEASES OF THE CEREBRO-SPINAL SYSTEM

DISEASES of the brain and spinal cord are less frequent than those of the respiratory and digestive systems. They are also less amenable to treatment, and are much more fatal. They largely increase the aggregate of deaths. They contrast with the diseases of the other systems in their greater relative frequency in infancy and childhood, than in adult life. This is explained, as regards the brain, by the rapid development of this organ in early life, its feeble consistency, its great impressibility by the emotions, and the thinness of the covering which protects it from external agencies.

Some of the most interesting of the cerebro-spinal diseases which are to engage our attention, are peculiar to early life, as tetanus neonatorum. The diseases of this system also contrast with other local affections in their greater obscurity, especially in their commencement; for while diseases of the thorax can be readily ascertained by auscultation and percussion, or those of the abdomen by the nature of the evacuations or the degree of tenderness or distension, our means of conducting examination through the bony encasement of the cerebro-spinal axis are meagre and unsatisfactory. The condition of the brain and spinal cord must be determined, chiefly, by the study of symptoms, and not by direct examination. The condition of the anterior fontanelle in young infants, however, enables us to determine the presence or absence of active congestion of the brain. If there is an excess of arterial blood, it is convex. Prominence of the fontanelle is common in inflammatory and febrile diseases, and is a sign of considerable diagnostic and prognostic value.

Within a few years, the ophthalmoscope has been employed as

a means of diagnosis in cerebral diseases, and although the employment of this instrument for such purpose is but recent, enough has been elicited to prove its great value as an aid in determining the state of the brain. Prof. H. D. Noyes truly and forcibly remarks: ". . . The argument for making ophthalmoscopic examination in all cases of brain disease, becomes irresistible. Indeed, a moment's reflection would lead to this conclusion without any considerations drawn from pathology. The optic nerve is only an outlying portion of the brain; its extremity is fully exposed to view. Situated within about two inches of the brain, it is the only nerve in the body which we can inspect; it contains blood-vessels which communicate directly with the intra-cranial circulation. We thus come into relation with the cerebrum, by continuity of nerve structure and also of bloodvessels."

Structural changes in the optic nerve and retina have been discovered by means of the ophthalmoscope in meningitis, hydrocephalus, phlebitis of the sinuses, apoplexy, etc. Among the lesions which have been observed by this instrument, are hyperæmia, more or less opacity and tenefaction of the optic nerve, engorgement of the vessels of the retina, with serous or sero-fibrinous exudation and ecchymotic points. In certain protracted diseases, as chronic hydrocephalus, in which dimness or loss of sight occurs, the ophthalmoscope discloses a state of atrophy of the optic nerve. Heretofore the ophthalmoscope has been chiefly employed by oculists, but as it comes into more general use, there can be little doubt that it will be recognized as an important aid in the diagnosis of cerebral diseases.

Still, with all possible aids to diagnosis, the obscurity which attends the invasion of many of the cerebro-spinal diseases must be acknowledged. To the hasty and careless physician, their symptoms are often deceptive. Careful weighing of the phenomena, and thorough and protracted examination are requisite, in order to insure correct diagnosis and proper treatment. Some of the cerebro-spinal affections are, in reality, sequelæ of other diseases, as, for example, spurious hydrocephalus; and some are, strictly speaking, only symptoms, as convulsions; but on account of their importance, and because they require special treatment, it is proper to consider them as diseases *per se*.

The brain presents some interesting features in infancy and childhood. In the fœtus, when the other organs are well formed,

the brain, especially its cerebral portion, is still diffused, and at birth it has so little consistence that it must be handled carefully to prevent laceration. This softness is due to the large proportion of water which it contains. The following analyses show the composition of the brain in the three periods of life:—

	Infant	Youth	Adult
Albumen	7.66	16.30	9.46
Cerebral salts	3.45	5.39	4.19
Phosphorus	.86	1.45	1.86
Oxidized, salts	5.56	8.39	19.19
Water	82.79	74.26	71.61

At birth the brain has a nearly uniform appearance as regards color. The gray substance, in which the nervous power originates, is undeveloped. The date of its appearance corresponds with the first exhibition of emotion or intelligence, and it is not completely formed until the age of full mental activity.

In the new born the brain is large in proportion to the rest of the body, and its growth during infancy and childhood is rapid. Until the fifth year, as appears from the observations of Dr. Pearson, its weight is about one-seventh or one-eighth that of the entire system, the proportion varying somewhat in different cases.

The brain does not attain its full size, as stated by Dr. West, at the age of seven years, but, according to Dr. Pearson's statistics, it continues to increase till the age of twenty-five or thirty, although its growth is less rapid after the age of seven years than previously.

The membranous covering of the cerebro-spinal axis is scarcely less interesting to the pathologist than the axis itself. I shall speak, in the following pages, of the arachnoid and cavity of the arachnoid for convenience of description, although aware of the fact that some eminent authorities, as Virchow and Kolliker, whose opinions in reference to the minute anatomy of the system always command attention, if not assent, believe that there is no arachnoid, but what has heretofore been called by this name is on the one side the smooth surface of the dura mater, and on the other of the pia mater.

The dura mater is seldom involved in the diseases of early life, except as it is affected by pressure, while the pia mater and arachnoid are the seat and source of some of the most important diseases, as meningitis, meningeal apoplexy, etc.

The more complicated and delicate the structure of an organ

the more liable is it to errors of nutrition and growth. There is, therefore, no organ which is so liable to irregular development as the brain. It may be entirely wanting, or it may be partially developed, certain portions being absent, or lastly, its growth may be excessive, constituting a true hypertrophy.

CHAPTER I.

ACEPHALUS—ANENCEPHALUS.

ENTIRE absence of the encephalon is not common, but there are many cases of this monstrosity on record. In extreme cases the head and part of the neck, as well as the brain and medulla oblongata, are absent. When there is great deficiency, there is often a twin, the presence of which has interfered with the full development of the system. Sometimes the growth of other organs besides the brain is imperfect.

ANATOMICAL CHARACTER.—In the ordinary form of *anencephalus*, the brain, and perhaps the medulla are absent, with the absence or imperfect development of their menbraneous and osseous covering. The vault of the cranium is absent. There is deficiency of the frontal, parietal, and occipital bones, except those portions which are near the base of the cranium. These portions are very thick and closely united, as if there were the usual amount of osseous substance, but instead of expanding into the arch, it had collected in an irregular mass at the base of the cranium.

The absence of the brain and the cranial arch gives a remarkable appearance. The eyes are prominent, the neck thick and short, while the body and limbs are ordinarily well developed. The physiognomy has been compared to that of some of the lower animals.

The base of the cranium is often occupied by a vascular tumor, not large, but of different size in different cases, and continuous below with the spinal pia mater. This vascular tumor is no doubt the representative of the cranial pia mater, and its smooth surface is apparently the analogue of the arachnoid. The dura mater and the scalp being absent, the exposed mass resembles

very much in appearance, as it does in structure, the placenta, and the sensation which it imparts to the finger pressed upon it is very similar. Sometimes small portions of cerebral matter are found among the vessels of this tumor, but they are so disconnected or isolated that they do not perform, in any way, the function of the brain. Occasionally the vascular tumor is absent, and the medulla or spinal extremity of the spine is exposed, or it terminates in a little papilla at the back of the neck.

Those portions of the cranial nerves which lie external to the cranium are well developed, although the intra-cranial parts may be absent.

SYMPTOMS.—The respiration in anencephalous monsters is irregular. They can be made to cry, but their cry is a sort of sob or hiccup, and, occasionally, they even nurse. The digestive function is well performed, and regular urinary and fecal evacuations occur. There is a tendency in anencephalous monsters to convulsions. Blowing upon them and pressure upon the projecting medulla, if this is present, frequently produce this effect.

PROGNOSIS.—Fortunately these monsters are short-lived. If the medulla oblongata is absent, which is essential to the maintenance of respiration, extra-uterine life is impossible. Still-birth is the result. If the medulla oblongata is present, although respiration and circulation are established, death commonly takes place within two or three days, and almost always within the first week. Convulsions sooner or later occur, ending in fatal coma.

CHAPTER II.

IMPERFECT BRAIN.

BETWEEN the absent and complete brain there are various grades of deficiency. Parts of the brain may be perfect, while other portions are either absent or imperfectly formed. The deficiency is usually in the superior parts of the brain, especially in the hemispheres of the cerebrum, while the base of the organ is perfect. Both hemispheres may be absent, or one may be absent, while the other hemisphere is shrivelled or rudimentary. Occa-

usually the encaphalon preserves its normal size by an increase in the cerebro-spinal fluid, proportionate to the lack of brain substance. The vigorous development is not then apparent from the shape of the cranium. Sometimes the rudimentary hemispheres are spread out, forming the walls of a sac inclosing the liquid. The post-mortem examination of such a case was made in the Nursery and Child's Hospital, of this city, in 1862.

The following is the record which I preserved of this case:—

CASE.—Female; parentage healthy; she was plump and well-formed at birth, and nothing unusual was observed in her condition, as she nursed and thrived like other children, till she reached the age when there is, usually, the first manifestation of intelligence. With her, there was no evidence of an intellect, or if any, it was very indistinct. She nursed, or took food when placed in her mouth, but apparently without relish, as if instinctively. She never reached her hands towards the nurse, or towards playthings. So indifferent and apparently unconscious was she of objects around her, that it was thought for some time that she was blind. She never smiled, except when her hands were gently rubbed or shaken; and then the smile seemed to be more a reflex movement than emotional. The smile was immediately succeeded by a fixed vacant look. She usually lay quietly, with her arms crossed; and during the last months of her life, she sometimes uttered a scream, like children with cerebral diseases. Her evacuations were regular, and she was not subject to vomiting, before she was attacked with the acute disease of which she died. The size of her head was rather less than usual at her age, but not less than is often seen in well formed children. The forehead was small in proportion to the rest of the head, but the difference was not such as to attract attention. Fortunately, the existence of this idiot was terminated by an attack of enterocolitis.

Section Cadaver.—The head was measured, but the measurements were lost. They did not seem to differ materially from the normal standard. The sutures were united, and the fontanelles nearly if not quite closed. The frontal bone lay a little lower than the plane of the parietal. The meninges of the brain presented nearly their normal appearance, but were distended with transparent serum. The quantity of fluid was estimated at about two-thirds of a pint, and when it was evacuated, the floor of the lateral ventricles was brought into view. There was almost an entire absence of that part of the brain which lies above the floor of the ventricles. On close inspection, rudimentary cerebral hemispheres were found in a thin layer forming a part of the walls of the sac. The whole amount of brain-substance above the ventricles did not exceed the size of a small egg. The cerebellum, the base of the brain, and cranial nerves presented their usual appearance. The entire brain, after being a few days in diluted alcohol, weighed six and a quarter ounces.

In this case, the fluid was only sufficient to compensate for the deficiency of the brain. In other, and probably the larger num-

ber of cases of incomplete brain, the cerebro-spinal fluid is not materially increased. There is then but slight elevation of the frontal bone, the forehead is low, or retreating, or even almost absent. There is that shape of head which is considered, in and out of the profession, as characteristic of idiocy.

Symptoms.—The symptoms in cases of deficient brain relate to the mind. If the cerebral hemispheres are absent, there is no intelligence. The individual, as regards mental endowments, does not rise above the instincts of the lower animals. If the hemispheres are partially developed, there is a degree of intelligence proportionate to the amount of cerebral substance present. If the deficiency is confined to one side, there is no apparent lack of intelligence, or mental capacity, since, the brain being a double organ, one side performs the function of both.

Prognosis.—The prognosis as regards life, in cases of imperfect brain, depends not so much on the amount of deficiency as the exact seat of arrested growth. If only the cerebrum is partially, or even entirely absent, the infant may live and thrive. But if those portions lying at the base of the brain, which control the functions of animal life, are lacking, or are imperfectly formed, life is very uncertain, and probably short.

It is evident that no therapeutic treatment can remedy a congenital deficiency. The services of the physician are not required. The philanthropist and patient teacher may impart a degree of intelligence to the idiotic, and the instruction of these unfortunate has of late years been very successful.

Microcephalus—Atrophy of Brain.

An abnormally small brain, or microcephalus, as it is termed, sometimes results from premature closing of the sutures and fontanelles. If ossification is so rapid that the cranial bones are firmly united, and are of such thickness as to be unyielding at the time when the growth of the brain is most active, the full development of this organ is necessarily prevented. The brain is compressed, its convolutions flattened, and the functions of the organ are imperfectly performed. Death, sooner or later, is the common result; life ends in convulsions and coma.

Again, the brain of the child, when undergoing development, with the cranial bones sufficiently yielding, may not only cause

to grow, but may even diminish in size, in consequence of protracted and exhausting diseases. Diminution in the size of the brain occurs, especially after fevers and diarrhoeal affections of long standing, and attended with much emaciation. The waste of the brain corresponds with the general loss of flesh. If the cranial sutures are not united, the occipital, and sometimes the frontal bones are depressed, according to the diminished size of the brain, and are overlaid by the parietal. In foundlings of two or three months, this loss of brain substance is often very striking. In infants of this class who have died of protracted diarrhoea, it is not unusual to observe the occipital bone not only depressed, but extending over, two, or even three lines underneath the parietal.

If the child with shrunken brain, from protracted and exhaustive disease, is old enough to express its thoughts, it often seems foolish, talks but little, and perhaps says the same thing over and over again. In one case in my practice, a little girl, having passed through a long course of typhus, persistently repeated during her convalescence, with a silly smile, the questions addressed to her. This peculiarity continued two or three weeks, although her appetite was good, and her restoration to health rapid. In another case a little boy, during convalescence, was wont to laugh heartily at the appearance of the ordinary articles of furniture in the room. Both showed more derangement of mind during convalescence than in the midst of the fever. The friends of such children are in a state of great anxiety lest their minds are permanently impaired, but, as the appetite and strength return, the nutrition of the brain is re-established, and the mind regains its former vigor. In cases of wasted brain, with cranial bones united, the deficiency is supplied by serous effusion, which is gradually absorbed as the health of the patient is re-established, and the brain enlarges. This effusion occurs not only over the convexity of the brain, but also at its base, and sometimes in the ventricles. Dr. West states, that in atrophy of the brain, from protracted disease, its texture is firmer than usual. I have not noticed this in infants, but my attention has not been directed particularly to this point. It is probable that there is some change in the anatomical character of the brain, aside from mere waste.

Partial atrophy of the brain sometimes, also, occurs from primary disease located in this organ; the affected portion wastes, while the rest retains its normal development.

CHAPTER III.

HYPERTROPHY OF BRAIN.

IN contrast with atrophy of the brain is the opposite state, or hypertrophy. The size of this organ within the limits of health varies greatly in different individuals, but sometimes there is so great an increase in volume as to properly constitute a disease.

PATHOLOGICAL ANATOMY.—The excess of growth which characterizes this disease, has been ascertained to be confined to the white portion of the brain, and ordinarily to that part contained in the cerebral hemispheres. Hypertrophy of the brain is attended by induration, which exists in different degrees in different cases. It is in some so slight as to be scarcely appreciable; while in others it is apparent at once by pressure with the finger, or when cut with the scalpel. Rilliet and Barthes state that the induration in some cases resembles in degree and appearance that produced by the action of alcohol. The white substance of the cerebrum is not only resisting and elastic, but its color is unusually pale; it presents even a brilliant or polished appearance. At the same time the gray substance is more or less faded, and its depth in the convolutions is less than in the normal state of the organ. Rokitsansky says: "The cineritious matter is generally of a pale grayish red color. The medullary is always dazzling white, and remarkably pale and anæmic." A case is related by Burnett, in which the gray substance in the corpora striata retained its usual color, and was indurated like the white substance. Hypertrophy in exceptional cases affects the cerebellum as well as the cerebrum, and is attended by more or less induration. In Burnett's case there was induration of the optic nerves. "The internal structure," he says, "of the optic nerves, especially in their bulbs, had the polish, homogeneous appearance, elasticity, and almost the hardness of cartilage." Rilliet and

Bartholin state that in two cases the spinal cord presented even more marked induration than the encephalon. Congestion is not a feature of hypertrophy. On the other hand, there is often less vascularity of the brain and its membranes than in the healthy state. If the cranial bones are completely ossified at the time when hypertrophy commences, and firmly united, enlargement of the brain is partially prevented. The convolutions are then thin, much flattened, the sulci more or less effaced, the membranes pale and dry, and the ventricles are small and nearly destitute of serum. At the autopsy of such a case, where the dura mater is incised, its expansion prevents the proper refitting of the skullcap. Occasionally hypertrophy causes more or less absorption of the cranium, and perhaps the sutures already united are pressed apart.

If hypertrophy commences in young infants with the fontanelles and sutures still open, they usually remain open, or are a long time in uniting. The interosseous continues, not only in consequence of the growth of the brain which tends to separate the bones, but also in consequence of feeble ossification. The shape of the head arrests attention. Hypertrophy usually produces most enlargement between and above the ears, while the frontal portion of the head, though somewhat enlarged, is less developed.

The direction of the eyes is not changed, as is common in congenital hydrocephalus.

Rokitansky says (vol. iii. page 285): "With regard to the question to be decided by theory and microscopic examination, as to the nature of the added material upon which the increase of volume depends, I have formed the following opinion from repeated investigations:—

"1. The disease is genuine hypertrophy.

"2. It consists as much, not in an increase in the number of nerve-tubes in the brain, from new ones being formed, nor in an increase in the dimensions of those which already exist, either as thickening of their sheaths, or as augmentation of their contents, by either of which the nerve-tubes would become more bulky:—but,

"3. It is an excessive accumulation of the intervening and connecting uncoloured substance."

It is now generally admitted that the views of Rokitansky are correct, that hypertrophy of the brain is due to an accumu-

tion in the amount of connective tissue, which lies between and unites the tubules.

CAUSES.—Hypertrophy of the brain is commonly associated with rickets, or scrofula, or some error in the nutritive process, which shows itself in other parts of the system as well as the brain. Biliot and Barthoz consider frequent congestion of the brain as a common cause of hypertrophy. This disease is not common in this country. It is most frequently met in hospitals for children, and among the poor of the cities, whose systems are rendered cachectic by residence in damp and dark localities, and by unwholesome diet. In the deep valleys of Switzerland, and in parts of South America, and Asia, hypertrophy of the brain is common, under the name cretinism. It is associated with rickets and stunted growth. The abnormal development which occurs in cretinism begins in infancy or early childhood, and the unfortunate subjects of it are short-lived. Cretinism is believed to be due to residence in localities wet and deprived in great measure of solar light, and to general disregard of the laws of health on the part of those affected as well as their parents.

The observations of different physicians also establish a connection between some cases of hypertrophy and the saturation of the system by lead. In what way lead poisoning leads to hypertrophy is obscure, but the concurrent testimony of different observers is so strong, that we cannot doubt that it does sometimes have that effect.

SYMPTOMS.—The symptoms, as is the case with most organic diseases of the brain, vary considerably in different cases. Sometimes there is, at first, more or less depression or languor. If the child is old enough to speak, he may complain of pain in the abdomen or limbs, evidently neuralgic, or of headache. After a variable time vomiting succeeds, and finally convulsions, affecting the muscles of the face, as well as extremities; the convulsions are usually clonic, but sometimes, as regards at least the extremities, of a tonic character. The pupils may be contracted or dilated; there is restlessness alternating with drowsiness, and, finally, coma succeeds.

Hypertrophy may continue a considerable time before serious symptoms arise; but when once developed, these symptoms ordinarily continue with more or less severity till death. Death commonly results within a week after their commencement, but,

sometimes, not till several weeks have elapsed. When death occurs at an early period in the disease, there is usually firm ossification and union of the cranial bones, and, therefore, but moderate enlargement of the cranium.

If hypertrophy commences at a period not far removed from birth, the bones, of course, yield more readily to the pressure, and acute symptoms do not occur so soon. After a time, however, in all, or nearly all cases, convulsions supervene. These indicate the gravity of the disease, and are prognostic of its fatal termination.

In a patient observed by Barnett, violent convulsions followed by loss of consciousness, marked the commencement of acute symptoms. Five days subsequently, the following symptoms were recorded: mobility of the eyes, without expression; pupils contracted and directed upwards; divergent strabismus of the left eye; the senses in their normal state, with the exception of sight; the limbs move by volition. For a month there was little change. Then occurred drowsiness, and increased prostration, and five weeks later, the child succumbed with the symptoms of double pneumonia.

Such is the clinical history of hypertrophy. In cases of firm ossification of the cranial bones, and, therefore, no marked enlargement of the skull, the symptoms are similar to those which occur if the dimensions of the head are increased, only compression and death result sooner.

The following case, in which the sutures were firmly united, I attended in 1864. The head was large, but not so large as to attract attention from its disproportion:—

CASE.—A boy, aged two years and two months, had, when about one year old, fever and ague, and since then his countenance was uniformly pallid, and his flesh soft. Weaned at the usual time, he remained well till the first of January, 1864. In the beginning of this month he was observed to be feverish for some days, and his appetite poor. His health then gradually improved, and he was thought to be entirely well.

On the 26th of February he was suddenly seized with convulsions, general at first, but most severe, and continuing longest on the left side. The convulsions lasted a little more than three hours. He recovered fully his consciousness by the following day, but his appetite remained poor; he was no longer amused by his playthings, and was very fretful. The surface was pallid; bowels constipated; pulse but little, perhaps not at all, accelerated. He continued in this state till the 6th of March, when he had another slight convulsive attack, and from this time he never fully recovered his consciousness. He

was feeble if disturbed, his face generally pallid, while the pulse and respiration were not perceptibly altered.

On the following day, the 21st, the left pupil was somewhat larger than the right, but both were sensitive to light. This difference in size continued till near the close of life. Although vision was imperfect, if not altogether lost, the sense of hearing was not impaired.

When questioned, he uniformly answered "no," with a drawing voice, evidently not understanding what he said.

As the disease advanced, the respiration became at times sighing; but the rhythm of the pulse was not materially altered. The temperature of the surface was changeable, sometimes cool, sometimes warm, and the congested spots or patches, so common in cerebral affections, were also observed at times on the face, ears, or forehead. Through most of his sickness, he took drinks readily, and the urine was freely discharged, probably from the iodide of potassium which he took in one and a half grain doses every two hours.

He became more and more drowsy, had again slight convulsive movements, and, finally, died, with much apparent suffering, on the 14th of March. The pulse became more accelerated during the last two or three days. On the day preceding his death, the pupils were contracted, and not affected by the light.

Section Cadaver.—Body somewhat emaciated, and eyes staked; occipito-frontal circumference of head nineteen and a half inches; distance from one auditory meatus to the other over the vertex, thirteen and a half inches; convolutions over the surface of the brain much fattened and compressed; brain generally deficient in blood; medullary substance firm, and of a pure white color; meninges healthy; no other abnormal appearances were observed; weight of brain forty-two ounces.

DIAGNOSIS.—The diagnosis of hypertrophy is not always easy. The symptoms are, in the main, such as occur in other pathological states, especially congenital hydrocephalus. There is most danger of mistaking the overgrowth for this disease. Hypertrophy has indeed often been treated for hydrocephalus. There are, however, certain signs by which we may distinguish one from the other. In the ordinary form of congenital hydrocephalus, even when the amount of liquid is small, the orbital plates of the frontal bones are pressed in such a way that the axis of the eyes is changed so as to have a downward direction. The white of the eye can be seen between the iris and the upper eyelid. This gives a characteristic and striking expression to the face. The exception to this is in those rare cases in which the liquid is external to the brain. In hypertrophy, on the other hand, at least in many cases, there is not that uniform expansion of the head which is observed in hydrocephalus, as has been stated above. There is, commonly, greater enlargement, more promi-

nence of the anterior fontanelle, and wider separation of the cranial bones in hydrocephalus than in hypertrophy. There are also in hypertrophy signs of a rachitic constitution.

Hypertrophy with consolidation of the cranial bones, and, therefore, little enlargement of the head, may be mistaken for meningitis. The history of the case and the means by which we diagnose the latter affection, which will be described in their proper place, will usually enable the physician to make a correct diagnosis.

Prognosis.—In forming an opinion as to the probable termination of the disease, we must have regard to the age and the general condition of the child, as well as to the degree of hypertrophy. If the disease commence at an early age, when the cranial bones are not firmly united, it is probable that there will be no compression of the brain, so as to endanger life, for a considerable period. We may then hope by proper measures to remove that constitutional state which gives rise to the hypertrophy, before it has attained that degree which causes those dangerous cerebral symptoms described above. If the bones have already united when the disease commences, even slight hypertrophy will produce symptoms, and a speedily fatal result is inevitable. Evidently, also, a child in a marked degree rachitic or scrofulous, is much less likely to recover than one whose general health and constitution are less impaired.

TREATMENT.—The treatment in hypertrophy should be directed mainly to the constitution. Measures calculated to improve the nutritive process are those most likely to check the abnormal growth of the brain. As the disease is one of perverted nutrition, and is associated with rickets, or scrofula, or some other vitiated or impoverished state of the blood, tonic and alterative remedies are required. The liquor ferri iodidi is, therefore, useful, as it is both tonic and alterative. This may be given in doses of four or five drops to a child one year old, three times daily. Cod-liver oil, with or without the iron, is beneficial in some cases. Another remedy is iodide of potassium in combination with a tonic, as the compound tincture of bark.

No. 1. R.—POTAS. IODID. ʒss.

Tinct. cinch. comp. ʒij.

One teaspoonful, three times daily, to a child of three years.

The hygienic treatment is of still greater importance than the

medicinal. There is little hope of a favorable issue in any case, unless the regimen is such as will conduce to a more robust and healthy state of system. The diet should be plain and restrictive, there should be exercise in the open air, and the residence should be in clean and airy apartments. All undue excitement should be avoided, and the brain should not be overtaxed by schooling or by rigid discipline.

CHAPTER IV.

THROMBOSIS IN THE CRANIAL SINUSES.

THE formation of fibrinous coagula within a vein or sinus is designated thrombosis (*thrombos*, clot). Coagulation of fibrin in the cranial sinuses occasionally occurs, constituting a very serious pathological state. This may result from local disease in the sinuses, or in their vicinity, or from disease external to the cranium. The immediate cause of thrombosis, whatever its location, is sufficient stasis of blood to allow coagulation of its fibrinous element.

Tubercular and enlarged bronchial glands, compressing more or less the vena innominata or the descending vena cava, sometimes give rise to thrombosis in the cranial sinuses, the fibrin coagulating in consequence of retardation in the current of blood. I have known thrombosis, in the same situation, also to result from clonic convulsions, occurring in connection with severe spasmodic cough in pertussis, since both the cough and convulsions retard the flow of blood in the veins and sinuses within the cranium. At the post-mortem examination of two such cases I found firm whitish clots in the lateral sinuses.

Thrombosis, in the cranial sinuses, may also occur from inflammation either in the walls of the sinuses, or immediately exterior to them. This is the disease which writers have designated phlebitis of the cranial sinuses, and for a correct understanding of the morbid anatomy of which the profession are indebted to Virchow.

ANATOMICAL CHARACTERS.—If a child die with the cranial sinuses, and the veins of the brain and of the meninges in their normal state, the blood in these vessels is found at the autopsy

dark but liquid, or there are small, dark, and soft clots in the larger sinuses. If there was congestion, but no coagulation in these vessels, in the last hours of life, the clots are more numerous, larger, and longer, sometimes extending from the sinuses into the larger veins, which empty into them, but they are still dark and soft, readily falling to pieces when handled. If, again, there has been that degree of congestion, and stasis, which has resulted in ante-mortem coagulation, or in thrombosis, the clots are, in part at least, whitish, of a fibrous or gelatinous appearance; they were formed while the blood disks were still carried along in the circulation.

Most of the clots in thrombosis are free, while others are attached slightly to the internal surface of the sinus; occasionally, they are so large as to distend the vessel. They have also been found, in some cases, in the cerebral veins, which connect with the sinuses, producing prominence and firmness, so as to resemble (Rilliet and Barthes) an artificial injection. The clots do not present a uniform character. In parts of a sinus they consist of almost pure fibrin, of a yellowish-white color, while in other portions they are more or less tinged from the presence of blood disks. The central part of the clot, after a time, if the case is sufficiently protracted, softens, and presents a puriform appearance. This was supposed to be pus, till the microscope revealed its true character. It is obvious, that small clots forming within a sinus, and having no attachment to its walls, are liable to be carried by the current of blood into the jugular vein, as long as the circulation continues. Virchow has also shown how a thrombus may extend, by gradual propagation, nearer and nearer the heart, so that one commencing in a sinus, may, after a time, reach into the jugular vein. Accordingly, different observers, as M. Tonnelle, and also Rilliet and Barthes, have traced the fibrinous masses as far as the cava. The latter writers relate the case of a girl, four and a half years old, in whom the sinuses on the left side, especially those nearest the petrous portion of the temporal bone, were completely filled with clots of a yellowish-white color, intermixed with central dark spots. Similar concretions were also found in the left jugular vein as far as the brachio-cephalic trunk. The coats of the sinuses, which contain the concretions, often do not present any appreciable alteration, but in other cases, there is thickening, and the internal surface is somewhat redder than in

the natural state. In an infant who died of this disease in the practice of Dr. West, "the sinuses on the left side were healthy, but the blood was almost entirely coagulated. The posterior half of the longitudinal sinus, the torcular, the left lateral, and the left occipital sinuses, were blocked up with fibrinous coagulum, precisely such as one sees in inflamed veins, and the clot extended into the internal jugular vein. The coats of the longitudinal, and of the inner half of the lateral sinus, were much thickened, and their lining membrane had lost its polish, was uneven, and presented a dirty appearance."

Billiet and Barthex say, that the internal membrane of the sinuses is almost always perfectly sound, and that its reddened appearance, occasionally observed, is due to imbibition of blood. These writers remark also that the cellular tissue which forms the external coat of the sinus, is sometimes manifestly thickened. This is indeed a common result of phlebitis, from interstitial deposition of fibrin.

The mode in which congestion and coagulation occur within a sinus, in consequence of the pressure of a tumor upon this vessel, or upon a vein, into which the blood from this sinus flows, is sufficiently obvious. The mode of the production of thrombosis, as a result of clonic convulsions, or of the spasmodic cough of pertussis, is also apparent. How it results from inflammation of the walls of a sinus, that is, from phlebitis, was not understood till explained by Virchow.

The fibrinous coagula which fill the sinuses are not an exudative product, as was formerly supposed. Inflammation (in most cases otitis, with caries of the petrous portion of the temporal bone) approaches a sinus. The inflammatory products pressing against the walls of the sinus diminish its calibre at that point, and hence the retardation of the current of blood and the coagulation. Or the walls of the sinus may be thickened by interstitial deposition of fibrin, or even by the formation of little abscesses within the coats in consequence of the inflammation, so as to produce bulging inwards, and the result, as regards the circulation, is the same. Whether, therefore, the inflammation occur without a sinus, or within its walls, thrombosis equally results, provided that the diameter of the vessel is sufficiently narrowed by the presence and pressure of inflammatory products.

There is no exudation on the internal surface of a sinus or

vein when inflamed as there is upon serous surfaces. "On the contrary" (*Cellular Pathology*. Translation, p. 236). "when the wall is inflamed, the exuded matter (exsudatissime) passes into the wall which becomes thicker, cloudy, and subsequently begins to suppurate. Nay, even abscesses may form which cause the wall to bulge on both sides like a varicelous pustule without any coagulation of the blood ensuing in the cavity of the vessel. At other times, certainly phlebitis, properly so called (and in like manner arteritis and endocarditis), is the cause of thrombosis in consequence of the formation of inequalities, elevations, depressions, and even ulcerations upon the inner wall which favor the production of the thrombus. Still, whenever phlebitis, in the usual sense of the word, takes place, the alteration in the coat of the vessel is almost always a secondary one, and indeed occurs at a comparatively late period."

This view of the pathology of thrombosis comports with facts observed at autopsies, and which cannot be explained according to the old theory of phlebitis, namely, smoothness of the internal surface of the sinus; natural color of this sinus, or simple staining from blood; the non-attachment or slight attachment of the coagula, &c.

CAUSES.—Some of these have been already stated at the commencement of this article. It is evident from what has been said that this disease may be produced by any cause which obstructs the return circulation from the head. I have already alluded to tumors which press upon the sinus or on the vein below the sinus as a cause. Among the causes may be mentioned also abdominal tumors, narrowing of the chest from rachitis, or caries of the vertebree, and finally compression of the jugular vein by a retro-pharyngeal abscess.

Sufficient allusion has already been made to inflammation of the internal ear as a not unfrequent cause. Thrombosis is indeed the most dangerous result of chronic otitis. Another cause is a reduced or cachectic state of system apart from any local obstructive disease. It is a noteworthy fact that a large proportion of those affected with thrombosis, even when it is immediately due to obstructive disease, are cachectic. The explanation of this fact is not difficult. In reduced states of the system, the action of the heart is feeble, and passive congestion of the vessels within the cranium is apt to occur. Passive congestion of the veins and sinuses in protracted diarrhoeal maladies which is described in

another part of this work, is an example in point. In this state of feeble circulation very slight obstructive disease may be sufficient to cause thrombosis.

SYMPTOMS.—The symptoms of this disease are often obscure. All of them may and do occur in other and more frequent diseases of the encephalon. In cases related by M. Tonnelli, cerebral symptoms were well marked, such as faintness, dilation of the pupils, strabismus, grinding of the teeth, convulsive movements. In other cases the symptoms have been observed. There may be an almost total absence of such symptoms as would direct attention to the state of the head. This is probably due to the sudden occurrence of death in these patients after the clots have formed. If the clots are large, death is usually sudden in consequence of congestion of the brain and meninges, which is proportionate to the amount of obstruction. Extravasations of blood or serous effusion not infrequently accompany the congestion and hasten the result.

Dr. West relates the case of a girl who had a mild attack of scarlet fever, at the age of eight months, and did not fully recover her health. She continued restless and feverish, and had two violent convulsions two weeks after the scarlatina. In the following months she had more or less anæsthesia, and when she was nearly a year old, another attack of convulsions occurred. Fluctuation was now observed in the abdomen, and in a few days a sero-purulent fluid began to escape from the umbilicus. When this discharge had continued eleven days, symptoms of effusion on the right side of the chest were suddenly developed. She grew weak and emaciated, and finally was seized with extreme faintness, with which she died in forty-eight hours, at the age of thirteen and a half months.

At the post-mortem examination a large amount of pus was found in the abdominal and right pleural cavities. On the right side the sinuses were filled with coagula, and their coats seemed healthy. The left lateral and occipital sinuses, the torcular and part of the longitudinal sinus also contained coagula, which extended into the jugular vein. The walls of the longitudinal sinus and the internal part of the lateral sinus were thickened, and their inner surface had lost its polish and was uneven. There was congestion of the brain, with points of extravasated blood. If, as is probable, the convulsions were due to some other cause,

the only symptoms which were clearly referable to the thrombosis was the sudden faintness.¹

DIAGNOSIS.—It is evident, from what has been said, that thrombosis of the cranial sinuses, can rarely be diagnosed with certainty. The pre-existence of otitis will sometimes lead us to suspect its presence, especially if the otitis has been accompanied by deep-seated pain. Symptoms of cerebral congestion, serous effusion, or apoplexy, occurring in connection with otitis, protracted convulsions, or glandular or other tumors situated so as to compress the vessels which return blood from the brain, indicate thrombosis.

PROGNOSIS.—The prognosis, in any case, is obviously unfavorable. The cause is, ordinarily, permanent, or not readily removed, so that the clots gradually increase. If the cause is local obstructive disease, death is almost certain, since, in nearly every instance, the obstruction is of such a nature that it cannot be removed by either medical or surgical treatment. It is possible that recovery might take place if the clots are few and small, and the cause of the thrombosis is mainly feebleness of circulation in consequence of a state of debility. We know that clots may liquefy, and their elements re-enter the circulation; but such a result of thrombosis in a cranial sinus, if it ever occurs, is doubtless rare. The thrombus, by its presence, increases the stasis in the circulation, and serves as a point of attachment around which more fibrin coagulates.

TREATMENT.—Thrombosis should be treated by cool applications to the head, in order to diminish the congestion, by stimulants and sustaining measures in case the systolic movement of the heart is feeble. Tonics, vegetable or ferrous, are indicated if there is a cachectic state.

¹ In the two cases of thrombosis occurring in peritonitis, already alluded to, and in which I was enabled to ascertain by post-mortem examination the presence and extent of the clots, the symptoms, which were clearly due to the thrombosis, were those of cerebral congestion. Among these symptoms stupor and, finally, coma were prominent. The convulsions which occurred in both cases were apparently a cause and not a result of the thrombosis.

CHAPTER V.

CONGESTION OF BRAIN.

Congestion of the brain is not peculiar to infancy and childhood, but is much more common in these periods of life than subsequently. This is due, in a great measure, to the fact that in the young, the circulation is more readily disturbed by moral as well as physical causes, than in the adult.

Congestion of the brain is, occasionally, primary; more frequently it occurs as a concomitant or sequel of some other affection. Diseases, whether constitutional or local, which in the adult have no appreciable effect on the vascularity of the brain, often cause in the child a decided increase of blood in this organ.

Cause.—Cerebral congestion is of two kinds: active and passive. The former results from a cause which directly affects the brain, and increases a flow of blood towards it, or from a cause operating, primarily, on the heart, and increasing the frequency and force of its systolic movement; the latter is due to some obstruction in the course of the circulation, or to too feeble propelling power on the part of the heart.

Among the causes which most frequently produce active congestion of the brain in the child, may be mentioned blows or falls on the head, excessive fatigue or excitement, heat, perhaps sometimes dentition, and also various inflammatory and febrile affections, especially in their first stages.

Cerebral symptoms occurring in the course of an essential fever are no doubt often due, in a great measure, to the irritating effect on the brain of the specific principle, whatever it may be, circulating in the blood. Occurring in inflammatory diseases which are localized elsewhere than within the cranium, they are often attributed to functional disturbance of the brain. The brain, it is said, sympathizes with the affected part through the system of nerves which unite them. But observations show that symptoms referable to the brain, arising in the commencement of the essential fevers and of the pylegmatie, are, in many instances,

preceded by, and are therefore, doubtless, in greater or less degree dependent on hyperæmia of this organ.

Difficult as it is to ascertain the state of the brain, in many diseases in which it is involved, we may determine whether or not there is congestion in the young child by observing the anterior fontanelle. If it be elevated and tense in an acute disease, hyperæmia is indicated. Now, it is often unusually prominent in fevers and inflammations, especially in their first stages, when cerebral symptoms are present. Its elevation, under such circumstances, is necessarily coincident with cerebral congestion.

The acute inflammations which are most likely to be attended by cerebral congestion, are those of the mucous surfaces, and pneumonia. Severe coryza, tracheo-bronchitis, entero-colitis, and colitis, commencing suddenly with great febrile excitement are, frequently, accompanied in their initial stage by active congestion of the cerebral vessels. Cases like the following, which I find in my note-book, are not infrequent. An infant four months old had been sick about two days with coryza and bronchitis, when I was called to see it; the pulse numbered 156; respiration 64; noisy, and was somewhat restless; cough frequent and dry; bowels moderately relaxed. The mucous membrane of the fauces was injected, and stercoræ mucous râles were present in the chest. The anterior fontanelle rose above the level of the cranium, and pulsated forcibly. Soon after, convulsions occurred, which were relieved by appropriate measures, and on the following day the fontanelle had subsided. The patient gradually recovered without any other untoward symptom.

Cerebral congestion and convulsions often mark the initial stage of active intestinal phlegmasiæ. This is especially true of dysentery. The little patient, perhaps from the very inception of the colitis, is drowsy; its surface hot; pulse full and rapid. There is sudden and momentary starting or twitching of the limbs. The anterior fontanelle, if still open, is elevated, and it is not till the lapse of several hours that the cause of these symptoms is apparent from the bloody stools.

The causes of passive congestion of the brain are very different from those of the active form. A common cause is obstruction in a sinus or vein, by a fibrinous concretion, or by a tumor or abscess external to it.

I have met a few cases in which this form of cerebral conges-

tion appeared to be plainly referable to obstruction to the return of blood from the brain by enlarged and tubercular bronchial glands. These diminished by external pressure the calibre of the *venae innominatæ* or the descending *vena cava*. Rilliet and Barthès have called attention to this fact, in the clinical history of tuberculous. The following case may be cited as an example.—

It occurred in the infants' service of Charity Hospital, in this city, in April, 1864. An infant, one year old, with phthisis, both bronchial and pulmonary, was observed during the ten days preceding its death, to bore the pillow with its head almost constantly, so as to wear the hair from the occiput. This movement of the head was the only prominent cerebral symptom. Nothing abnormal was noticed in the appearance of the eyes, nor was the stomach irritable. A spasmodic cough and progressive emaciation attracted attention, but these were referable to the tubercular disease. At the autopsy, we found the cerebral sinuses, veins, and capillaries greatly congested. On tracing the veins which return blood from the brain, an inflamed and enlarged bronchial gland was discovered in the angle formed by the convergence of the right and left *venae innominatæ*. This gland, which contained but a single point of tubercular exudation, had attained such a volume by proliferation of its cells, that it pressed upon both vessels, so that it had obviously retarded the circulation in each, and given rise to the cerebral congestion.

Passive congestion often occurs in the infant at birth, either from tediousness of the labor, or delay in the expulsion of the body after the birth of the head. If it is simple congestion, and not congestion with hemorrhage, it soon passes off. Passive congestion of the brain, also, occurs in severe paroxysms of whooping-cough, in which return of blood from this organ is temporarily retarded. Under the same circumstances, congestion of the capillaries on the exterior of the cranium, is often such that they are ruptured, as is seen by extravasations occurring under the conjunctiva, and by epistaxis. These hemorrhages indicate the degree of internal as well as external congestion.

Those who practise in malarious regions sometimes meet cases of dangerous passive congestion of the brain, the result of malaria. It occurs especially in the cold stage of intermittent fever. In these cases, the surface is pallid; its temperature reduced; the pulse feeble. The blood, leaving the peripheral vessels, collects

in undue quantity in the internal organs, producing congestion of the brain, as well as of the thoracic and abdominal viscera. In the child with malarious disease, in whom there is less vigor of constitution than in the adult, death not unfrequently occurs from this passive congestion. Two such cases have occurred in my practice, although in this latitude the malarious affections are mild in comparison with the type which they present in many parts of the United States.

SYMPTOMS.—The symptoms of **ACTIVE** congestion of the brain are stupor, great heat of head, throbbing of carotids, restlessness when aroused, twitching of the limbs, and perhaps convulsions. There is also sometimes intolerance of light, and the anterior fontanelle, if open, pulsates strongly. In **PASSIVE** congestion, many of the symptoms are the same as in the active form. Stupor, twitching of the limbs, and restlessness or irritability when disturbed, are common, but there is not ordinarily any increase of temperature; the surface may, indeed, be cool, and the face is not flushed nor the eyes injected. The strong pulsation and the elevation of the anterior fontanelle, so conspicuous in active congestion, are—the former always, the latter often—lacking. In both forms there is a tendency to constipation.

In many cases, the symptoms of congestion of the brain are associated with others which proceed directly from the cause of the congestion, but it is not difficult unless in exceptional instances, to determine which are due to the congestion, and which to the antecedent and coexisting pathological state.

ANATOMICAL CHARACTERS.—In active congestion there is an excess of arterial blood in the brain and its membranes. The arteries, to their minutest branches, are seen to be full, presenting the bright hue of oxygenated blood. In **PASSIVE** congestion the sinuses and veins of the brain are distended. The pia mater, the choroid plexus, and the vessels of the brain have a darker appearance than in active congestion. In both forms of congestion, if they continue for a little time, other anatomical changes occur. If there is great distension of the capillaries, these vessels are apt to give way, and we find here and there little patches of extravasated blood. In other cases, the over-distension is relieved by the transudation of the serous portion of the blood through the coats of the vessels. The cerebrospinal fluid is then found in excess external to the brain and in the ventricles.

PROGNOSIS.—The duration and the result of congestion of the brain depend, in great measure, on the nature of the cause. If the cause is trivial, as mental excitement, fatigue, exposure to heat, there is usually prompt relief if the condition of the patient is understood and properly treated. If the cause is general or constitutional, as one of the essential fevers or whooping-cough, or if it is local, but its seat external to the cranium, the prognosis so far as the congestion is concerned is not unfavorable if there is a timely and judicious use of remedies. The most unfavorable cases are those in which the cause is seated in the encephalon, and those in which there is some obstructive disease in the course of the circulation. Congestion occurring from a structural change within the cranium, is from the nature of the cause without remedy and ordinarily fatal. Obstructive diseases of the circulatory system, wherever located, being for the most part permanent, give rise, as a rule, to incurable congestion.

Congestion of the brain, if it is not relieved in a few hours, becomes less and less amenable to treatment. It soon passes beyond the resources of our art, and ends in coma; it is seldom protracted beyond a few days. Extravasations of blood common in active congestion, and serous effusion common in the passive form, diminish the chances of a favorable result.

TREATMENT.—The indication for treatment in active congestion is plain. Measures should be employed which have a derivative effect from the brain. Unless there is an asthenic primary affection, in the course of which the congestion is developed, active purgation is required. A saline purgative is ordinarily preferable. If the stomach is irritable, there is no better purgative than calomel. In all cases of active congestion, whatever the cause, the bowels should be kept open. It is often better not to wait for the tardy action of a cathartic, but to give at once an emema of soap and water or salt and water. External derivative agents are also indicated. A warm mustard foot-bath, sinapisms to the back of the neck or chest, and to the feet, and cold applications to the head, are measures which should never be neglected. *

This treatment, if employed early, will relieve the congestion in a large proportion of cases, but if there is no improvement, if the child is robust, and if the primary affection be such as does not contra-indicate the loss of blood, leeches should be applied to the temples or some part of the head. If after the lapse of some

hours cerebral symptoms continue, apoplexy or serous effusion has probably occurred. Congestion is then no longer the prominent lesion, and it is proper to designate the disease by another name.

The treatment appropriate to passive congestion is somewhat different; cold applications to the head and those of a derivative nature to the extremities are useful. As this form of the disease is not primary, but is dependent on some antecedent pathological state, it is evident that it can only be treated successfully by removing or obviating as far as possible the cause. But the nature of the various obstructions to the inter-cranial circulation is such that our ability to accomplish this end is very limited.

If the cause is constitutional, or if it be some disease in the neck or chest, it may sometimes be partially or even wholly removed, but if seated within the cranium it is beyond our control. In general it may be said that depletion is not required or tolerated in passive congestion, and occasionally stimulants are needed.

CHAPTER VI.

INTERCRANIAL HEMORRHAGE—(MENINGEAL HEMORRHAGE—CEREBRAL HEMORRHAGE.)

HEMORRHAGE within the cranium is not very infrequent in infancy and childhood; and there is no part of the encephalon, whether the meninges or brain, in which it does not sometimes occur. If the blood is extravasated upon the surface of the brain or between the meninges, the disease is designated by writers meningeal apoplexy; if in the substance of the brain, cerebral apoplexy. Extravasation may also occur in one of the lateral ventricles. This may, for convenience, be described as a form of meningeal apoplexy.

CAUSES.—Apoplexy is usually (there is an exception) preceded by congestion. If the congestion increases to a certain degree, the distended capillaries give away and extravasation of blood results. Therefore the causes of congestion which have been enumerated in the preceding article are, in great measure, those of apoplexy. Recent microscopic examinations have demon-

strated that the corpuscular elements of the blood may escape from capillaries without rupture. While, therefore, it is probable that intercranial hemorrhage in early life commonly occurs upon a rupture, its occasional occurrence through the walls of the capillaries must be admitted.

Inter-cranial hemorrhage is not infrequent in the new born. It results in them from tediousness of the birth, and severity of the labor-pains. At first there is extreme congestion of the meningeal and cerebral vessels corresponding with that of the scalp and face. This congestion continuing, soon ends in extravasation of blood. In some of these cases forceps have been used to effect the delivery, but it is doubtful whether the use of instruments materially increases the congestion or the amount of extravasation. Certainly in a large proportion of inter-cranial as well as supra-cranial hemorrhage of the new-born, instruments have not been used. An additional cause of the hemorrhage is in some instances the use of ergot, which, by producing strong and continuous pains, interrupts the placental circulation and increases the congestion of the fetal veins and capillaries.

In infants a few days old inter-cranial hemorrhage may result from that rapid and fatal disease, tetanus neonatorum. The hemorrhage is preceded by intense passive congestion which the tetanic rigidity and spasms produce by obstructing respiration and circulation. Few cases of tetanus neonatorum occur without more or less extravasation of blood, either meningeal or cerebral. Another cause of this disease is obstruction in the vessels which return the blood from the brain. The various structural changes which produce this obstruction, in different cases, have been sufficiently described in our remarks on cerebral congestion and thrombosis.

The congestion which precedes hemorrhage, when occurring as described above, is passive.

Among the causes which produce hemorrhage through the intermediate state of active congestion, may be mentioned great mental excitement, of which M. Legendre relates a case, lengthened exposure to the sun's rays, an example of which Billiet and Barthet have seen. It is also said that compression of the aorta by an enlarged liver or an abdominal tumor has sometimes produced meningeal or cerebral hemorrhage by causing an increased afflux of blood to the head. A very important cause to which I

have not alluded, and which is probably not preceded by congestion, is an enfeebled state of system, especially that form of cachexia which is designated scorbutic. This state of system in many patients is the result of some antecedent disease, protracted, debilitating, and which has produced a profound alteration in the state of the blood and the vessels. The capillaries become less firm and elastic, and easily give way, so that in such patients ecchymotic points are ordinarily found in different parts of the system. The diseases which occasionally end in this hemorrhagic diathesis are numerous. I have known it to occur after measles, scarlet fever, and smallpox. It is also an occasional sequel of chronic diarrhoea, of intermittent and typhoid fevers, and of rachitis.

ANATOMICAL CHARACTERS.—Hemorrhage in or upon the brain in infancy and childhood, differs in important particulars from that occurring in adult life. In the adult, and more so as life advances, the arteries become less distensible and more brittle, so that when hemorrhage occurs it is usually from one of these vessels. In early life, on the other hand, the blood does not ordinarily escape from an artery, but, as has been stated, from the capillaries. The extravasation is not, therefore, so rapid and violent, and is not attended with such laceration and injury of surrounding parts in infancy and childhood, as at a subsequent age. In the adult, the hemorrhage commonly occurs in the substance of the brain. The flow of blood from the ruptured artery separates the brain substance producing a cavity in which a clot forms. This constitutes the usual form of apoplexy in the adult. In the first years of life, on the contrary, the extravasation is commonly from the capillaries of the meninges; it is external to the brain. Cases of hemorrhage in the substance of the brain constitute a small minority, unless during the days immediately succeeding birth. In early life, therefore, on account of its greater frequency, meningeal hemorrhage is a disease of more importance than cerebral, and its anatomical character should be carefully studied.

In *meningeal hemorrhage* the extravasation may be between the cranium and dura mater, upon the visceral layer of the arachnoid, in the meshes of the pia mater, or in a lateral ventricle, from rupture of the capillaries in the choroid plexus. Much the most common seat is external to the pia mater in the so-called cavity of the arachnoid; the blood coagulating in this situation spreads

uniformly in all directions. It soon separates in two portions, the solid and liquid. The solid portion, or the clot, is free or but slightly attached to the adjacent membrane. The meninges in the vicinity of the extravasated blood preserve their normal appearance, or are but slightly injected; the clot gradually becomes extended on all sides so as to form a lamina at the seat of the extravasation, thinner at its circumference than centre, and at first of a dark red color. The color gradually fades, and the lamina becoming smooth and polished, and at the same time more and more attenuated, finally resembles the arachnoid in appearance. Its diameter varies in different cases from a few lines to two or three or more inches. M. Tonnellé relates two observations in which the adventitious membrane extended over the superior surface of both hemispheres, and in one of them also, over the falx cerebri.

The extravasation may occur at any part of the surface of the brain, but its usual seat is the vertex. The next most frequent locality is the base of the brain. The subsequent history of the delicate membrane into which the clot is gradually transformed, is interesting. It often extends so as to cover more space than was occupied by the extravasated blood. Its edges are then scarcely distinguished, in consequence of their extreme tenuity, and their close resemblance to the arachnoid. The attachments of this membrane, so far as it forms any, are usually to the parietal surface of the arachnoid. Sometimes a portion of the membrane is attached, while the rest lies free, bathed on either side by the liquid portion of the blood which still remains from the extravasation. According to M. Legendre, in the most favorable cases, the serum is absorbed, and the membrane which has resulted from the clot, and which I have described, becomes intimately adherent to the internal surface of the dura mater. It forms an integral part of this membrane, and there only remain a little thickening and increased opacity, indicating the seat of the extravasation. The health is fully re-established.

But the result in other cases is as follows. The serum is not absorbed, and the newly-formed membrane, uniting at points with the inner surface of the dura mater, or its arachnoidal covering, incloses the fluid so as to produce a circumscribed hydrocephalus.

Sometimes there is only one cyst; in other instances the membrane, especially if large, unites in such a way as to give rise to more cysts than one. The size of the cyst varies, the quantity of

fluid varying from an ounce, or a part of an ounce, to several ounces. Rilliet and Barthex report a case in which there was a pint of fluid lying over each hemisphere, there being two cysts. If the cranial bones are not united so that they yield to the pressure, the size of the cranium is increased, and if the extravasation is confined to one side, an inequality results, and the symmetry of the head is destroyed. The fluid which causes the enlargement of the head in such cases, is only in part the serum of the extravasated blood. It is, in great measure, a subsequent secretion.

Various writers relate cases of ventricular hemorrhage. Val-lex met it in an infant that died at the age of two days. In the *Edin. Journ. of Med. and Surg.*, October, 1831, an interesting case is related. A boy, six years old, died of hemorrhage in both ventricles, and also at the base of the brain, and in the spinal canal. In the Nursery and Child's Hospital of this city, the post-mortem examination was made of an infant who died at the age of one month. In the posterior cornu of the left lateral ventricle were two clots elongated and black, one larger than the other. In the corresponding cornu, on the opposite side, was a smaller clot. A similar post-mortem appearance was observed at the autopsy of a young infant in the infant service of Charity Hospital. A dark crescentic clot lay in each posterior cornu. The clot, if remaining a long time, undergoes degeneration. In one case, in which a year had elapsed after the extravasation, I found it to contain crystals of cholesterine and carbonate of lime.

CEREBRAL HEMORRHAGE, or hemorrhage in the substance of the brain, may occur at any time in infancy and childhood. The blood is sometimes extravasated in points, here and there over the entire organ, or a part of the organ; in other cases it is extravasated in one or perhaps two cavities, as in the ordinary form of apoplexy in the adult. In the first form of cerebral hemorrhage, or that in which the blood escapes from numerous points through the brain, there is evidently little laceration or injury of the organ. The brain substance surrounding the hemorrhagic points sometimes preserves the usual appearance. It is white and firm. In other cases it presents a reddish or yellowish appearance, and is softened to the depth of a line or two. If the hemorrhage occurs in a cavity, as in apoplexy of adults, the nerve-fibres are evidently torn and separated, and there is more or less compression of the surrounding brain substance. Unless the disease is of long standing, the cavity contains a dark and soft clot

bathed with serum, which has a reddish or a yellowish-red appearance. The brain in the immediate vicinity of the cavity is sometimes softened. Billiet and Barthex state that they have seen eight cases of cerebral hemorrhage of the capillary form; ten cases in which the hemorrhage was in cavities; and in two of the eighteen both forms were present. In five of those in which the form was capillary the disease was limited to portions of the brain, while in the remaining three, the hemorrhagic points were found in nearly every part of the brain.

Apoplectic cavities are seldom seen in the cerebellum, and whether the hemorrhage be capillary or in a cavity, there is, in most cases, as previously stated, more or less congestion of the vessels of the brain.

The proportion of cases of cerebral to other forms of hemorrhage is believed by some to be greater in the new-born than at any other period of early life. Valleix relates four cases of inter-cranial hemorrhage occurring at this age, two of which were cerebral, one ventricular, and in the other the extravasation was in the cavity of the arachnoid. Mignot has published eight cases occurring in the new-born, in two of which the hemorrhage was in cavities in the cerebrum; in three, in the lateral ventricles; and in three, external to the brain. If the same proportion be observed in other statistics, one in three of the cases of inter-cranial hemorrhage occurring in the new-born is cerebral.

SYMPTOMS.—The symptoms in inter-cranial hemorrhage are not uniform; they vary according to the seat as well as the quantity of the effused blood. In some cases the extravasation occurs without such symptoms as would direct attention to the brain. When the hemorrhage occurs at the time of birth, in consequence of the strong and long-continued labor-pains, the infant is often born apparently dead. This is due partly to the hemorrhage, partly to the great congestion of the brain which precedes and accompanies the hemorrhage. Resuscitation is gradual and difficult. The infant's features are livid and perhaps swollen, its respiration is gasping, and both pulse and respiration are slow. Its cry is feeble, with but slight movement of the facial muscles, and the lungs are but partially inflated; the eyelids are closed, and the limbs almost motionless. By artificial respiration and by friction, the pulse and breathing may be rendered more frequent, but the latter remains irregular and gasping. Finally, the limbs grow cold, the surface from a state of lividity becomes pallid, and death

occurs in profound coma. M. Cruveilhier made many observations at the "Maternity" in reference to the death of new-born infants, and he believes that one-third of those who die in birth, at the full period, die of apoplexy. I have made post-mortem examinations of two who died from this cause, and in both the hemorrhage was meningeal. One of these was born on the 30th of December, 1864. The birth was delayed by unusual projection of the promontory of the sacrum, so that finally the application of forceps was necessary. The infant was apparently still-born, but by persistent efforts on the part of the physician who assisted, it was resuscitated so as to live several hours, though with constant embarrassment of respiration and with lividity. At the autopsy a large extravasation of blood was found in the cavity of the arachnoid, over a considerable part of the convexity of the brain, and the substance of the brain was deeply congested.

Apoplexy in the new-born does not always terminate fatally, or, when fatal, in the sudden manner which I have described. Valleix relates the case of an infant who died of pneumonia at the age of three and a half months. Its birth had been protracted and difficult, but was completed without the use of instruments. It had had during its entire life paralysis of the right side. At the autopsy a clot was found near the base of the right thalamus opticus, evidently existing from birth. Around the clot the brain was softened to the depth of some lines, and was of a bluish-red color. A very similar case is related by M. Vernois. An infant lived forty-nine days with paralysis of the left side, and died of pneumonia. At the autopsy a hemorrhagic excavation in the process of coagulation was found behind the right corpus striatum and the thalamus opticus.

Inter-cranial hemorrhage occurring from accidents of birth is generally attended by marked symptoms, such as have been described. But when it occurs subsequently to birth, whether in infancy or childhood, the symptoms vary greatly in different cases, and are generally obscure. I will briefly state the symptoms which have been observed in both the cerebral and meningeal forms of this disease. First, the cerebral. Sédillot relates the case of a child seven and a half years old, whose bare head had been exposed several hours to the sun's rays. Suddenly, after a paroxysm of anger, it was seized with great pain, corresponding with the posterior and inferior fossæ of the cranium. It uttered piercing cries, and died in a quarter of an hour. A clot was

found in the right lobe of the cerebellum. Richard Quain (Billiet and Barthex) gives the history of a boy nine years old, who in playing with a hoop suddenly stopped, carried his hands to his head, and fell backwards unconscious. Three or four hours afterwards, when examined, he was found pale, surface cool, respiration slow and at times stertorous, pulse 50 to 60 per minute; the left arm was flexed; the left leg paralyzed; right leg and arm convulsed; right pupil strongly dilated, the left contracted. He died seven hours after the commencement of the attack, and a large clot was found in the centrum ovale on the right side.

Billiet and Barthex relate the following case from Campbell. A boy with good previous health was suddenly seized about 7 A. M. with repeated vomiting, and in an hour and a half with violent convulsions; he rolled his eyes and uttered inarticulate cries; pulse frequent and hard; pupils contracted; trunk and lower extremities cool. In the afternoon he presented symptoms of compression of the brain, such as dilatation of the pupils, frequent and feeble pulse. Death occurred in the evening, and a hemorrhagic cavity was found occupying the right middle lobe of the cerebrum. Gilbert relates a case of extravasation in the superior part of the right hemisphere of the brain in a boy fourteen years old. The principal symptoms were feebleness of the limbs, inability to walk, cephalalgia, involuntary evacuations, fever, grinding the teeth, rigors severe and prolonged, lividity, loss of intellectual faculties, dilation of the pupils, insensibility to light, stertorous respiration. Death occurred in about an hour.

Billiet and Barthex narrate the history of a girl two years old, who after an attack of measles was taken with convulsions accompanied with fever and prostration. The convulsive movements affected especially the eyes and upper extremities; the right leg was immovable; the left pupil dilated. These symptoms resulted from hemorrhage in the corpus striatum and opticus thalamus. The same authors relate also the case of a girl, seven years old, who died with a large apoplectic cavity in the left thalamus optice. The symptoms were headache, convulsive movements, loss of consciousness, delirium, vomiting and constipation, convergent strabismus. These symptoms nearly disappeared, but in a few days the headache returned with strabismus and a slight drawing of the face towards the left; on the twenty-seventh day there were some convulsive movements of the right eye with paralysis of the arm.

Finally, contraction of the arms occurred with acceleration of pulse; irregular breathing; dilated pupils; paralysis; retraction of the head; and death on the forty-eighth day.

These cases, and those from Valleix and Vernois, which have been related in our remarks on hemorrhage of the new-born, are sufficient to show the character of the symptoms in that form of cerebral hemorrhage in which the extravasated blood forms a cavity in the interior of the brain.

If the amount of extravasation is large and the substance of the brain is much lacerated and compressed, death may occur almost immediately, and, therefore, without symptoms, or before it is possible to determine whether or not symptoms are present. If the disease is not so speedily fatal, the symptoms, as appears from the above cases, are headache, confusion of thought, or even insensibility, cries, sometimes piercing, cold extremities, pallor, slow and perhaps stertorous respiration, convulsive movements followed by paralysis, or convulsions affecting one or more limbs with paralysis of others, pupils contracted or dilated, sometimes one contracted and the other dilated, strabismus, rolling of eyes, vomiting.

These symptoms have all been observed in different cases, but they are not all present in any one case. Those which are generally present, and on which we mainly rely for diagnosis, are headache, convulsive movements, paralysis, confusion of thought, irregularity in the pupils, and strabismus.

In the CAPILLARY form of cerebral hemorrhage there is usually some complication, so that it is not easy to determine how far symptoms are due to the hemorrhage, and how far to the coexisting pathological state.

There are indeed but few published observations of capillary hemorrhage in the substance of the brain uncomplicated with meningeal hemorrhage, hemorrhage in a cavity, or some other and distinct disease, but so far as I have been able to ascertain the symptoms referable to this form of extravasation, they are as follows. The child is drowsy; fretful when disturbed; it perhaps moans. There are sometimes slight convulsive movements and partial paralysis. If there is considerable extravasation, the respiration is irregular and sighing. Death occurs in coma occasionally preceded by convulsions. Taupin relates the case of a child nine years old, who died with this form of hemorrhage,

accompanied by softening of the brain. The disease began at night, with delirium, agitation and piercing cries. In the morning, the patient lay in bed, drowsy, not complaining of pain, and not replying to questions; pupils dilated, and insensible to light; left eye half-open during sleep, and its axis changed; eyebrows contracted; face pale; mouth open; had no convulsions, but transient stiffening of the limbs, during which the thumbs were firmly compressed by the fingers; senses unimpaired, but the face drawn to the right; deglutition difficult; pulse small, irregular, and feeble; respiration 22, sighing. In the evening, he lost rigidity of the limbs and back, and, finally, was taken with general convulsions, in which he died at eleven o'clock. The hæmorrhagic points in this case were numerous. A boy five years old, whose case is described by Rilliet and Barthez, died of this disease, pneumonia, and white softening of the intestine. During the last five days there were cerebral symptoms, the chief of which were drowsiness, restlessness when disturbed, and moaning without apparent cause. Another child, whose case is described by Rilliet and Barthez, died at the age of four years, with cerebral capillary hæmorrhage, accompanied by yellow softening. Six months before death he had general convulsions, followed by spasmodic movements of the left side. These subsided, but the left side remained feeble.

In MENINGEAL HÆMORRHAGE there are often convulsions, general or partial, in some patients tonic, in others clonic. When partial, the convulsive movements may occur only in the muscles of the face and eyes. With the spasmodic muscular action is a degree of drowsiness and irritability. Paralysis, so common in the apoplexy of the adult, and not infrequent, as we have seen, in the cerebral form of early life, is sometimes, but not ordinarily, present in meningeal hæmorrhage. Instead of paralysis, there are vomiting, some febrile action, thirst and loss of appetite. The symptoms are different, however, according to the exact seat of the hæmorrhagic extravasation, and the duration of the disease. If the extravasation end in the formation of a cyst, the symptoms are those of hydrocephalus. The following condensed history of cases which I have selected as typical, will give us a clearer idea of the history and course of the various forms of meningeal hæmorrhage, than can be imparted by a narration of symptoms:—

M. Tonnelle relates the case of a child who was taken with faintness and convulsive movements. On the following day the trunk and inferior extremities became rigid; deglutition was painful; the pupils were largely dilated, immovable, face pale; pulse feeble and intermittent. Death occurred the same day. The dura mater was distended. A layer of coagulated blood of great thickness, extended over the convexity of each hemisphere. The veins ramifying in the superior part of each hemisphere were distended with coagulated blood. The hemorrhage was in the meshes of the pia mater. Drs. Lombard and Puzosard, of Geneva, relate a somewhat similar case. A child, thirteen months old, was convalescing from inflammation of the bronchial and intestinal mucous surfaces, when it was seized with general convulsions; the mouth and eyes were open, and the eyes directed upwards; pupils contracted; pulse frequent and irregular. The convulsions abated somewhat, but soon reappeared with violence. The patient became insensible, and died nineteen hours after the commencement of cerebral symptoms. The extravasated blood covered the upper surface of both hemispheres. From the above cases, we see the symptoms and the course of meningeal hemorrhage, when the extravasation is so large that death speedily results. In protracted cases of meningeal hemorrhage, there is either a gradual disappearance of symptoms and return to health, or, circumscribed hydrocephalus occurring, the symptoms of that disease arise.

DIAGNOSIS.—It is evident from what has been stated that the diagnosis of intracranial hemorrhage is attended with unusual difficulty, since the symptoms of this disease occur also in other and distinct pathological states. The history of the case, and especially the character of the cause, if ascertained, will aid in diagnosis. If there has been an obvious determination of blood to the brain, or some known obstruction to the return of blood from that organ, the persistence of cerebral symptoms would justify us in concluding that either serous or sanguineous effusion had supervened on a state of congestion. The points of differential diagnosis between apoplexy and meningitis are the sudden and full development of symptoms in one case, the gradual commencement and gradual increase of symptoms in the other; difference of symptoms in some respects, for example, as regards febrile reaction, constipation, etc.

There is one symptom in cerebral hemorrhage which is of great diagnostic value, namely, paralysis. Its progress affords strong evidence that there is extravasation of blood, and probably in a cavity in the substance of the brain. If the extravasation end in the formation of a cyst, the symptoms and appearances of hydrocephalus, which, after a time, arise, throw light on the nature of the disease.

PROGNOSIS.—There can be no doubt that many cases of inter-cranial hemorrhage occur and terminate favorably without the nature of the disease being suspected. In such cases the amount of extravasated blood is small or moderate. In several published cases in which the accuracy of the diagnosis was shown by post-mortem examinations, the patients were convalescing from the hemorrhage when they succumbed to intercurrent diseases. If, however, the amount of extravasated blood is such as to give rise to those symptoms which have been described, the prognosis is unfavorable. Recurring convulsions and persistent stupor, from which it is difficult to arouse the patient, are unfavorable symptoms. If the convulsions cease, and consciousness returns, even if there is paralysis, the result may be favorable.

TREATMENT.—The proper treatment in inter-cranial hemorrhage depends on the state of the patient, the time which has elapsed since the extravasation and the degree of it, as shown by the nature and severity of the symptoms. If, as is often the case, the patient is robust, and is visited soon after the commencement of the attack, cold applications should be made to the head, mustard to the back of the neck and perhaps chest, and derivation should be produced by mustard pediluvia. In many cases, especially in active congestion it is advisable to apply leeches to the temples, and the bowels should be opened by a stimulating enema. In active congestion, also, prompt purgation by salines or other cathartics is sometimes of great importance. The object of such treatment is to relieve congestion of the cerebral and meningeal vessels, and thereby prevent further extravasation of blood. If the congestion be active, the pulse continue full and frequent, and the face be flushed, it is proper in many cases to control the action of the heart by a sedative. For this purpose the tincture of *veratrum viride* may be given in doses of one drop to a child five years old, repeated in three hours if necessary, or *aconite* may be employed. If the stupor or convulsions continue

after sufficient time has elapsed for the patient to receive the full benefit of the above remedies, more active counter-irritation is required. Cantharidal collodion should be applied behind each ear. If the hemorrhage occur from passive congestion, or in a cachectic state of system, active depressing remedies should not be employed. External derivatives are of service as well as cool applications to the head, and we should attempt, as far as possible, to remove the cause of the congestion and hemorrhage. If it depend on a cachectic state, tonic or other remedies calculated to relieve this state are indicated. The hemorrhage from such a cause is apt to be in points in the substance of the brain, or in moderate quantity over the surface of this organ, and by a timely use of constitutional remedies, possibly we may prevent further extravasation of blood and increase the chance of the patient's recovery.

If a cyst result from the hemorrhagic effusion, the treatment which is proper is that described in the chapter on Acquired Hydrocephalus.

CHAPTER VII.

CONGENITAL HYDROCEPHALUS.

CONGENITAL hydrocephalus consists in an excess of the cerebro-spinal fluid, lying either external to the brain, or more frequently in its interior. It is due to some vice in the development of the brain or its membranes, or to a pathological state occurring in them during intra-uterine life. This disease is ordinarily apparent from the symptoms and appearances at birth, but not always. Occasionally nothing unusual is observed in the shape of the head or aspect of the infant till after the lapse of some weeks, when the characteristic physiognomy begins to appear. In these cases the disease is still congenital, as there is every reason to believe that the abnormal state to which the excessive production of fluid is due existed from birth. In cases of arrested or partial development of the brain, as, for example, when a considerable portion of the hemispheres is absent, there

is often an unusually large quantity of fluid which serves merely as a compensation for the lack of brain. I do not regard such cases as examples of hydrocephalic disease, since the effect of the fluid is not injurious, but rather useful. I restrict the term congenital hydrocephalus to those cases in which the brain is complete, or if incomplete, the quantity of fluid is more than sufficient to supply the deficiency.

ANATOMICAL CHARACTERS.—According to M. Breschet the fluid in congenital hydrocephalus may be, 1st, between the dura mater and the cranium; 2d, between the dura mater and the parietal arachnoid; 3d, in the cavity of the arachnoid; 4th, in the ventricles; 5th, between the arachnoid and the brain.

In a large majority of hydrocephalic patients the seat of the effusion is the ventricles. As the quantity of fluid increases, the pressure from within gradually unfolds the convolutions of the brain, at the same time producing expansion of the cranial arch. When the amount of fluid is considerable, and it becomes so in the course of a few weeks or months, the hemispheres are spread out in a thin lamina on either side, gradually decreasing in thickness from the base of the cranium to the vertex, where the brain substance is sometimes so thin as to be scarcely perceptible. Complete absence of brain in this situation, namely, at the vertex,



Congenital hydrocephalus. (From Gross.)

even in extreme cases of expansion and flattening of the hemispheres from the pressure of the liquid is rare, though the brain

substance at this point is sometimes almost as thin as either of the membranes, so that the wall of the sac is translucent. The membranes which surround the brain do not usually undergo any alteration, except such as arises from the distension. The *falx cerebri* sometimes disappears, and sometimes the meninges present a whiter hue from ulceration than in health. The distension also causes such an expansion of the pia mater that it becomes very thin, and in places scarcely visible, but its presence in every point can be demonstrated.

The changes which the cranial bones undergo, both in their chemical character and in their shape in hydrocephalic patients, if the amount of fluid is considerable, are interesting and remarkable. The base of the cranium undergoes little change, but those portions of the frontal, parietal, and occipital bones, which constitute the arch, are expanded in all directions, while they become much thinner. There is deficiency of lime in their constitution, so that their organic elements are greatly in excess. This renders them flexible and semi-transparent. Notwithstanding the expansion of the bones there are usually interspaces between them, of greater or less size, according to the amount of fluid.

The scalp being stretched by the pressure within becomes taut and thin, and is scantily covered with hair. The veins, which ramify in it, are unusually prominent and large, and the head is elastic on pressure from the amount of liquid beneath. In the common form of congenital hydrocephalus, namely, that in which the liquid is in the interior of the brain: the slope of the orbital plates of the frontal bone is changed, so that the eyeballs have a downward direction. This change in the axis of the eyes occurs at an early period and it continues through the entire disease, becoming more and more marked as the quantity of liquid increases. If the amount be large, the lower part of the cornea is buried under the under eyelid, while the conjunctiva is visible between the cornea and the upper eyelid. The persistent downward direction of the eyes is characteristic of this disease, and in connection with enlargement of the head is an important diagnostic sign.

If we examine the interior of the cavity after the fluid is evacuated we will find at its base the parts which lie in the floor of the lateral ventricles, but changed in appearance in consequence of pressure. The cornua are enlarged, and the *thalami optici* and

corpora striata are flattened. In the early stages of the disease, when the amount of fluid is small, there is probably no absorption or destruction of parts in the interior of the brain. The various portions of this organ retain nearly their normal relation to each other. As the quantity of fluid increases the foramen of Monro, which unites the lateral ventricles, becomes enlarged, the septum lucidum which separates them disappears, and the two ventricles form a common cavity. In most fatal cases we find this single large cavity. The surface which surrounds the cavity occasionally presents a whitish or semi-opaque appearance, which has led to the belief, on the part of some, that at a period antecedent to birth there was subacute inflammation of this surface, and hence the effusion.

The bones of the face are ordinarily less developed than in healthy children of the same age, so that the disproportion between the head and face becomes a marked peculiarity. The shape of the forehead and face is nearly triangular.

The foregoing remarks in reference to the anatomical characters of congenital hydrocephalus refer in the main to cases which have continued for a considerable time, so that their characteristic features are well marked. In very young infants, in whom the disease is still recent, similar anatomical characters are present, but in less degree.

Congenital hydrocephalus is often associated with other vices of conformation, especially with *spina bifida*. The two when coexisting are only parts of the same disease; the large quantity of cerebro-spinal fluid preventing the spinal canal from closing during fetal development.

The fluid in congenital hydrocephalus consists largely of water, in the proportion even of 99 parts to 100. In addition to this element, there are traces of albumen, chloride of sodium, phosphate and carbonate of soda, and caseine.

I have had an opportunity to witness only one post-mortem examination in a case of congenital hydrocephalus in which the liquid was exterior to the brain. This case was under observation in the children's service of Charity Hospital, in 1866. Full notes and measurements of the head were taken, which unfortunately were mislaid or lost. The infant had congenital syphilis, and had a pallid, strumous appearance. The shape and relative size of the

head are seen in the accompanying figure, from a photograph. While the whole head was enlarged, there was a relative excess of development in the part between and above the ears. The axis of the eyes was not at all changed, and the vision was good. The appearance corresponded so closely with West's description of hypertrophy of the brain, that this was supposed to be the



anatomical state. Anti-syphilitic treatment was employed, and the syphilitic eruptions had nearly disappeared, when diarrhoea supervened, followed by death. At the autopsy, a quantity of transparent or light straw-colored liquid, estimated at six or seven ounces, was found exterior to the brain, in the great cavity of the arachnoid, lying mostly over the superior surface of the organ. There was no excess of liquid in the ventricles, and the brain, though of good size, was not abnormally large, nor did it possess the firmness which is present in true hypertrophy.

All cases of congenital hydrocephalus may be embraced in two groups, namely, that in which the liquid is in the interior of the brain, and that in which it lies exterior to the organ. Liquid primarily in the arachnoidæan cavity permeates the meshes of the *pia mater*, and lies in part underneath it, or this delicate membrane may be ruptured. Four of the groups, therefore, described by Breschet, may properly be reduced to one, namely, those groups in which the liquid lies under, between, or external to the meninges. It is probable that some of the cases which led to Breschet's classification, were examples of acquired circumscribed hydrocephalus, the result of extravasation of blood. In this form of hydrocephalus, as is stated elsewhere, an adventitious

membrane forms external to the liquid, becoming in time thin and delicate, and often bearing a close resemblance to the normal membrane (especially the arachnoid), for which it is sometimes mistaken.

SYMPTOMS.—If there is a considerable amount of hydrocephalic fluid prior to the birth of the child, so that the head is abnormally large, parturition is seriously interfered with. The scalp and meninges may become ruptured by the severity of the pains so that the fluid escapes. If this does not occur, the labor is often necessarily instrumental. Whether the liquid is present before birth or accumulate subsequently to it, the tendency is to an increase of the quantity, and a corresponding enlargement of the head.

The digestive function in this disease is at first well performed. The infant nurses readily, and has its evacuations with the regularity of other children. Not many weeks, however, elapse in the majority of cases, before defective nutrition is apparent.

While the volume of the head increases other parts are imperfectly nourished and stunted in their growth. Emaciation is common of the neck, trunk, and limbs, associated with progressive feebleness. In the last stages of this disease there is more or less vomiting, with constipation. If there was previously the ability to support the head, it is now lost, and the erect position is no longer possible. In marked cases when there is great disproportion between the head and the rest of the system there is, frequently, not even the ability to rotate the head on the pillow. As long as the cranial bones yield readily to the pressure from within and there is no compression of the brain, the function of this organ is not seriously impaired. The child recognizes its mother or nurse, and it can be amused like other children, though easily fatigued. The state of the senses is different in different cases, and sometimes at different stages of the same case. The sight and hearing in some are perfect, in others impaired, while in others still they are good at first but gradually become obscured and lost. It is said that the sense of smell may be perverted so that agreeable odors are unpleasant, and *vice versa*. Many reaching the age at which children begin to walk cannot walk, or if they do, it is with a tottering unsteady gait.

When the liquid increases to that extent, and it usually does sooner or later, that the brain begins to be compressed, dangerous

cerebral symptoms arise. The child becomes drowsy, and takes less notice of objects. There is twitching of the limbs and finally convulsions. The pupils act feebly or irregularly by light, or one is more dilated than the other. Strabismus also occurs. As a fatal termination approaches, convulsions occur, partial or general. These are soon succeeded by the last stage, that of coma, in which the patient expires.

The following case, which I copy from my note-book, is an example of the common form of congenital hydrocephalus. It will give an idea of the ordinary course of this disease, and show the difficulty which we meet with in its treatment. Female, born Nov. 9th, 1859, with the aid of forceps. At birth the fontanelles were unusually large, the cranial bones separated, and the aspect in a marked degree hydrocephalic. She nursed at first, but the mother's milk failing she was afterwards bottle fed. At the age of four months her head, which had increased faster than her general growth, measured from one auditory meatus to the other, over the vertex, seventeen inches; the occipito-frontal circumference twenty-three inches. At this time she manifested considerable intelligence, being able to distinguish her mother from other persons, though the head was so large that it was necessary to support it constantly on a pillow. From the age of four to six months the operation of tapping was performed six times with a small hydrocele trocar, by Prof. Stephen Smith, at a point near the coronal suture and from an inch to an inch and a half from the sagittal. At each operation an amount of fluid varying from twelve ounces to one pint was removed, and the head then covered with strips of adhesive plaster, so as to form a complete cap. It was necessary, however, within the twelve hours succeeding each operation, to loosen the dressing, on account of either the occurrence of convulsions or symptoms premonitory of them. The head, within a week of each operation, uniformly regained its former size, and as there was no permanent benefit this treatment was discontinued. She finally died of enterocolitis at the age of ten months and five days.

At the autopsy the distance from one auditory meatus to the other was twenty and a quarter inches; the occipito-frontal circumference twenty-six and a quarter inches. The anterior fontanelle measured antero-posteriorly four and three-fourth inches; transversely, seven and three-fourth inches. The parietal bones

were separated from each other to the distance of two or three inches, and they measured in length nine and one-half inches.

On opening the cranial cavity seven pints, by measurement, of transparent fluid escaped, exposing a vast open space, at the bottom of which were the parts which constitute the floor of the ventricles, somewhat changed in shape, and from them, on either side, the hemisphere was spread in a lamina, so as to cover the internal surface of the cranial bones. The laminae near the base of the brain measured in thickness from half an inch to one inch, and they gradually became thinner on approaching the vertex, at which point the brain substance was exceedingly thin, if not absent.

The brain had its normal vascularity and consistence, and the cerebellum, medulla oblongata, the base of the brain, and cranial nerves presented their usual appearance. On folding the brain together, it had the size, shape, and aspect of this organ in its ordinary development. Nothing unusual was observed in the membranes except their great expansion. The above case corresponds in its general features with most cases met in practice.

DIAGNOSIS.—The ordinary form of congenital hydrocephalus, that in which the liquid occupies the interior of the brain, can, in most cases be readily diagnosticated. If there is only a moderate amount of liquid, it may be confounded with hypertrophy of the brain. In hydrocephalus, there is commonly more rapid growth, and greater expansion of the head, moreover, the enlargement occurs equally on all sides, while in hypertrophy, though all parts of the cranial vault are expanded, the enlargement is, according to West, more at the vertex than elsewhere. The sign, however, of greatest diagnostic value is the direction of the axis of the eyes. In hypertrophy the axis is unchanged, while in this form of hydrocephalus, although the amount of liquid may be small, the change of axis occurs which is described above. In rickets the volume of the head is often considerably enlarged, due sometimes, in part, at least, to a deposit of calcareous matter on the exterior of the cranial bones. The differential diagnosis is based on the shape of the head, round in one, square or with prominences in the other, on palpation, direction of the eyes, &c. The smaller the amount of liquid the greater the liability to error of diagnosis, but if the amount is inconsiderable and not increasing, little treatment is required, except hygienic and tonic, which is also proper

in both hypertrophy and rachitis. If the liquid is exterior to the brain, as in the case represented on page 115, diagnosis may be difficult, but such cases seldom occur.

PROGNOSIS.—This is unfavorable. The amount of liquid in congenital hydrocephalus, as already stated, commonly increases. The most favorable result is no increase, or but slight, in the quantity, while the natural growth of the infant continues, and thus the disproportion between the head and the rest of the system gradually disappears. This result is exceptional. Ordinarily, while the quantity of fluid increases, the nutrition of the body and limbs is more and more deficient. The patient, if not cut off by some inter-current disease, finally succumbs with cerebral symptoms produced by pressure of the fluid. The majority of those affected with congenital hydrocephalus die in infancy, but some enter childhood, and, occasionally, one reaches even adult life. Cases of recovery have been reported. In such, if genuine, evidently, the disease was mild, and the amount of liquid small or moderate.

TREATMENT.—It is a proper question, in many cases, whether anything should be done to relieve the hydrocephalic infant besides attending to its general health. The anxiety of parents, however, hopeless the nature of the case if left to itself, reported recoveries, and the fact that we have medicines, which in many instances diminish the amount of liquid in the internal cavities, incline us to the use of therapeutic measures.

We may attempt to diminish the quantity of fluid by the use of diuretics. Digitalis, squilla, nitrate and acetate of potash have been used. Probably the most efficient diuretic in these cases is iodide of potassium. This may be given in doses of one to two grains every two hours to an infant of six months. Constipation, if present, should be relieved by an occasional purgative. If it is tolerated we may partially prevent the expansion of the head by a close-fitting cap. For this purpose strips of adhesive plaster, about one-third of an inch in width, should be applied so as to cover the entire head. The proper way of applying these is as follows: first, one strip from each mastoid process to the outer part of the orbit on the opposite side; secondly, from the back of the neck along the longitudinal sinus, to the root of the nose; thirdly, over the whole head, so that the different strips will cross each other at the vertex; and lastly, a strip long enough to pass

three times around the head should be applied, passing above the eyebrows, the ears, and below the occipital protuberance. Too tight an application should be avoided, as it may give rise to convulsions or other cerebral symptoms. If the cap can be tolerated, and the general health is good, the prospect is more favorable; but usually from the increase in the quantity of fluid it is necessary in a few days to remove or loosen the plasters in order to prevent convulsions. If this treatment is not successful, we may finally resort to tapping. The mode of performing this operation has already been indicated in the case which I have detailed. No appreciable good result has followed the use of irritating or astringent applications in this disease. Nutritious diet and attention to the general health are requisite.

CHAPTER VIII.

ACQUIRED HYDROCEPHALUS.

HYDROCEPHALUS, or dropsy of the brain, may also occur in those who, at birth, are well-formed and free from disease. Pathologists call this acquired hydrocephalus. It is, in nearly all cases, the result of disease which is located, sometimes within the cranium, but often in other parts of the system.

CAUSES.—The diseases within the cranium which most frequently produce serous effusion are the meningeal inflammations, both simple and tubercular, tumors or other causes which obstruct the venous circulation, and hemorrhagic effusions ending in the formation of cysts. Prolonged passive congestion often ends in transudation of serum through the coats of the capillaries. Therefore, all these causes of congestion, except such as have a transient or momentary effect, may be regarded as causes of serous effusion.

Among the diseases external to the cranium which produce serous effusion, within or upon the brain, may be mentioned retro-pharyngeal abscess, tubercularization or inflammation of the bronchial glands, scarlet fever, and certain affections of an exhausting nature, especially protracted diarrhoeal maladies. In four cases which have fallen under my notice, the cause was enlarged tubercular bronchial glands, which by pressure on the *venæ innominatæ*, so

retarded the flow of blood from the brain as to cause congestion and effusion. The causative relation of these glands to cerebral congestion is more fully described in our remarks in reference to this disease.

Dropsy of the brain is the common result of protracted diarrhoeal affections in infancy, whether enterocolitis or non-inflammatory diarrhoea. It is preceded and accompanied by passive congestion of the cerebral veins and sinuses, due in part to feebleness of circulation in consequence of the exhausted state of the patient, and in part to the wasting of the brain, which always gives rise to more or less passive congestion, unless in young infants in whom the cranial bones become depressed and override each other. Dropsy of the brain resulting from scarlet fever, and that peculiar circumscribed dropsy which results from hemorrhagic effusions are described elsewhere.

A few cases have been related by different observers, Abercrombie among others, in which dropsy of the brain seemed to be essential. Nothing abnormal was observed, with the exception of serous effusion. But the reports of such cases are, for the most part, meagre; and as Barrier has well said, we are not to accept such cases as examples of essential dropsy of the brain, unless the post-mortem inspection is so complete as to render it certain that there was no antecedent disease to which the dropsy was due.

ANATOMICAL CHARACTERS.—Acquired hydrocephalus usually occurs after the cranial bones are firmly united, and, therefore, the shape of the head is not materially altered. If it occur at an early age, before there is firm union, there may be expansion of the cranial arch, as we sometimes observe in the circumscribed hydrocephalus resulting from hemorrhage. The effusion in acquired hydrocephalus occurs over the surface of the brain, in the sub-arachnoid space, or in the lateral ventricles. In the dropsy of protracted diarrhoeal maladies, I have rarely failed to find the liquid over the whole superior surface of the brain as well as at its base.

The quantity of fluid in this disease is not large. In the majority of cases it does not exceed four ounces, and is often much less. It is transparent, or it has a slightly yellowish tinge. The membranes of the brain sometimes present their normal appearance, but in other cases are injected. The brain itself, in some cases, presents an injected appearance from passive congestion of the veins and sinuses; but, in other cases, when there has

been more or less compression of the brain, there is no more than the ordinary, or even less than the ordinary vascularity, and the convolutions are somewhat flattened.

SYMPTOMS.—The symptoms of the pathological state, which gives rise to the dropsy, precede and accompany those which are referable to the dropsy itself. The dropsy declares itself by symptoms, which are alarming from the first.

In children old enough to speak, or manifest intelligence, there may be at first complaint of headache. The child is irritable, its mind confused or wandering at times, or there is actual delirium. After a time drowsiness occurs. The head seems too heavy for the body and is buried in the pillow. In fatal cases the features become pallid, the pupils sluggish, and perception and consciousness are gradually lost. The child lies in profound sleep which is restless. There are now often convulsive movements, partial or general, and these soon end in coma, in which the patient dies.

PROGNOSIS.—Acquired hydrocephalus commonly ends unfavorably. The prognosis depends not only on the quantity of liquid, but on the nature of the cause. If the cause be venous obstruction within the cranium or thorax, as we have no means of removing it, death is inevitable. If it be an exhausting disease, as enterocolitis or scarlet fever, although the case is not absolutely hopeless, the prospect is still unfavorable. It is only favorable when the quantity of effused fluid is small, the system not much reduced, and the primary disease mild. When acquired hydrocephalus arises from meningeal apoplexy, the case is apt to be chronic. The symptoms and termination of this form of the disease are very similar to those in congenital hydrocephalus.

TREATMENT.—The treatment in acquired hydrocephalus must vary somewhat in different cases, according to the nature of the disease on which it depends. I shall indicate the treatment, in part at least, in the description of these diseases. Occasionally the condition of the patient is such that there is little to encourage us in the employment of any remedial measures. In vigorous children, if acquired hydrocephalus occur in connection with symptoms which indicate too active a circulation, moderate abstraction of blood from the temples at an early period may be useful, but cases requiring such depletory measures are rare. These cases require cold applications to the head; the bowels

should be opened, and derivatives should be applied to the feet and back of the neck.

If the congestion be of a passive character, as where the circulation is obstructed by tumors, or otherwise, benefit may still be derived from cold applications to the head, and derivatives to other parts. In most cases of suspected dropsy of the brain, unless the patient is in such a hopeless state that all treatment is obviously futile, venesection should be produced behind the ears. I prefer cantharidal collodion for this purpose. In addition to this treatment, diuretics should be employed, unless there is too great prostration, or the course of the disease is so rapid that no benefit can result in consequence of the tardy action of these agents. The best diuretics are the acetate of potash and iodide of potassium.

CHAPTER IX.

MENINGITIS, SIMPLE AND TUBERCULAR.

THE most interesting and important disease of the cerebro-spinal system in early life, is that now known as meningitis, or inflammation of the meninges. It is not infrequent. The mortuary statistics of this city show that it is the cause of death in from one in twenty-five to one in fifty of the entire number of deaths, the proportion varying somewhat in different years. The tubercular form is more common in the city than in the country, and in hospital than in private practice.

In 1768, the attention of the profession was particularly called to this disease, by Dr. Whytt, of Edinburgh. This observer, and the pathologists succeeding him, forming their opinion of meningitis from its most prominent anatomical character, namely, serous effusion, believed it a dropsy. They accordingly designated it acute hydrocephalus. During the last thirty years the profession have come to regard the disease as inflammatory, and hence the name by which it is now known, and which is believed to express its true pathological character.

Sometimes meningitis, like other inflammations, occurs in

children previously healthy and robust. It is, under such circumstances, produced by causes which we often cannot fully appreciate. In other instances, it occurs in those affected by tubercular disease, and in many, if not in all of these cases, there is tubercular deposit in or under the meninges, which excites the inflammation in the same manner as in the lungs it causes pneumonia or pleuritis; therefore two forms of meningitis are recognized, namely, simple and tubercular.

I have preserved records of forty-three fatal cases of meningitis, most of which occurred in private practice. One was treated in the Episcopal Orphan Asylum, of this city, three in the Nursery and Child's Hospital, and four in the children's service of Charity Hospital. Post-mortem examinations were made in eleven cases. Twenty-three of the whole number were under the age of one year, and of these fifteen were strong and fleshy when the meningitis commenced; three of the twenty-three were in a cachectic state, but apparently without tubercular disease; three had tubercular disease, as shown by the post-mortem examination, while the condition of the remaining two was not recorded. Of those over the age of one year, thirteen were pallid, and in poor health previously to the meningitis, presenting either symptoms of struma or tuberculosis; five had good previous health, while the state of the other two was not recorded.

I regard these statistics as more valuable on account of their being furnished mainly by private instead of hospital practice, since hospital practice gives a larger proportion of tubercular cases. In no one of the forty-three was there any accompanying disease, which would materially modify the symptoms or result, unless we except spinal meningitis in one case and pneumonia in another. In these patients, therefore, simple meningitis was more frequent than the tubercular form under the age of one year, and, I may say, eighteen months. Above this age, a large proportion were scrofulous or in a state of cachexia, some of them with previous tubercular disease in the lungs and bronchial glands, and the tubercular form of meningitis was therefore more frequent. It was, indeed, the usual form.

As pathologists become better acquainted with the character of the microscopic elements in meningeal inflammation, as will be seen hereafter, many of those cases which would once have been considered tubercular are ascertained to be simple. In a large

majority of those under the age of eighteen months whom I have treated in private practice, not only their general health and previous condition negatived the idea that the meningitis was tubercular, but there was certainly no tubercular predisposition in them, as they belonged to robust and healthy families.

The belief has prevailed in the profession, that tubercular meningitis does not occur in young infants. This idea is fallacious, although, as has been stated, meningitis under the age of one year is, in most cases, independent of tubercular deposition or diathesis. Bouchut, speaking in reference to tubercular meningitis, says: "Up to this period it was not believed that this disease existed in young children, for no mention is made of it in the works of Denis and Billard. Still its existence at this age is, nevertheless, incontestable. MM. de Blache, Guersant, Rilliet and Barthet, and Barrier have observed several examples of it, and I have collected six cases of this disease in the practice of M. Trousseau. The youngest child was only three months old, and the eldest had arrived at the end of his second year. No statistics can be based on so small a number of facts; the only value they have consists in their overruling an opinion falsely accredited in medical science." I have witnessed the post-mortem examination of only one case of tubercular meningitis occurring under the age of four months; nor was, in this case, the presence of tubercles in the pia mater positively demonstrated, although the lungs were studded with them, as were also the spleen and liver, and they were found underneath the costal pleura and the serous coat of the intestines. Granulations were observed at the base of the brain, but they were not properly examined for the tubercle corpuscle. I did not hesitate to consider the meningitis tubercular, for reasons to be stated hereafter, especially as the tubercular disease was so general. This case occurred in the children's service of Charity Hospital, in May, 1867, and the infant was two months old. As stated elsewhere, I have made post-mortem examinations of two other infants under the age of one year, in whom tuberculosis coexisted with the meningitis.

In patients over the age of eighteen months, although the proportion of tubercular to simple cases is larger than under this age, it is not so great, according to my observations, as most statistics would lead us to suppose. There can be no accurate statistics of tubercular meningitis without careful post-mortem examination.

of each case in which it is supposed to have occurred, and this examination sometimes shows the meningitis to be simple, when the symptoms and physical signs had indicated its tubercular character. As an example, may be mentioned a case which occurred in the children's service of Charity Hospital, in March, 1868. This infant died at the age of twenty months, having had a cough of moderate severity at least three weeks before death, and symptoms of meningitis about four days. It was considerably wasted, and was supposed to have tuberculosis. At the autopsy, no tubercles were found in any part of the body, but parts of both lungs were hepatized. A fibrinous deposit, varying in thickness, was found over the pons Varolii, the optic commissure, along the fissures of Sylvius, over the superior surface of the anterior half of each hemisphere, and over the posterior surface of each hemisphere. As a careful examination failed to discover any tubercular deposit, the meningitis was obviously simple.

AGE.—The following table gives the age in meningitis, simple and tubercular, in forty cases in my collection:—

CASES.	AGE.
1	8½ weeks. (Autopsy.)
2	2 months.
18	From 3 to 12 "
19	" 1 year to 2 years.
7	" 2 years to 5 "
4	Over 5 years.
—	
40	

Billiet and Barthès have also published statistics of the age in meningitis. Their cases were observed chiefly in hospital practice, and the result is somewhat different.

In thirty-two cases of simple meningitis observed by these authors, eight were under the age of one year, six from two years to five, and eighteen over the age of five years. In ninety-eight cases of tubercular meningitis, there were two under the age of one year, fifty-one between the ages of one year and five, thirty-eight between the ages of five years and ten, and seven between ten and fifteen years.

ANATOMICAL CHARACTERS.—The dura mater in meningeal inflammation is either not affected at all, or it is affected secondarily. In many cases it retains its normal appearance, its internal surface remaining smooth and polished. In others it is more or less in-

jected, and its arachnoidal surface is dim or lustreless. Ordinarily, also, the free surface of the visceral arachnoid continues unchanged. It sometimes becomes dry and even cloudy or opaque, especially when it covers those parts which are most intensely inflamed. Exudation upon the free surface of the arachnoid is rare. Those who have had the most ample opportunities for observation record but few cases of it. Occasionally, when the inflammation has been severe, pus has been found, and sometimes serous effusion with or without fibrinous exudation upon the superior surface of the visceral arachnoid. The exudation presents different appearances according to the duration and severity of the disease. If the inflammation has continued several days, has not been violent, the liquid portion of the exudation may be more or less absorbed, so that the substance which remains has greater density than at first.

In both forms of *meningitis* the inflammatory action commences in the pia mater, and is usually confined to this membrane. In its meshes or underneath them, the lesions occur which characterize the disease. The pia mater is injected over a greater or less extent of surface, usually at the base of the brain alone, or at the base of the brain in greater degree than elsewhere. The inflammation is ordinarily most intense around the pons Varolii, in the subarachnoid space, and along the fissures of Sylvius. In addition to the augmented vascularity of the pia mater, we find an effusion of serum, fibrin, and pus, the quantity and proportion of these elements varying greatly in different cases.

The exudation of fibrin is greatest along the course of the vessels, and the opacity is most marked in this situation. Pus, when present, is almost semi-solid, from the small proportion of liquor puris which it contains, even in recent cases. If the disease have continued several days, the liquor puris may be mostly absorbed, and the pus-cells becoming shrivelled, irregular, and aggregated, may resemble closely the cheesy transformation of tubercle cells.

The fibrinous exudation presents features of interest. It does not usually attain much thickness, but by its opacity it conceals from view the brain underneath. If it occur in the fissures of Sylvius, the anterior and middle lobes are united by it. It is usually infiltrated through the substance of the pia mater, but sometimes it is collected in little masses of variable size, often not as large as a pin's head. These masses are firm, of a whitish

color, or a light yellow, and their number varies in different cases. They consist of a firm, homogeneous substance, containing granular matter, and cells which often bear a close resemblance to tubercle corpuscles, but which are distinct. They are plastic nuclei, or plastic cells, often shrunken. It is seen, then, that there are two morbid products, which may be mistaken for tubercle: one, pus which has been in great measure deprived of its liquid element; the other, plastic exudation, collected in little bodies, so as to resemble the ordinary form of crude tubercle. I once carried to one of the best microscopists and pathologists of this city some of the exudation which I had examined with the microscope, and found to contain plastic nuclei or cells, which could not readily be distinguished from shrunken tubercle corpuscles. The exudation was from a child two years and eight months old, with good health previously to the meningitis; without tubercles in any part of the body, with parents healthy, and with no predisposition to tubercular disease. This microscopist, not knowing the history of the case, or character of the family, pronounced the exudation tubercular. Boeckst says: "The whitish milky granulations which are observed on the surface of the pia mater, have a certain consistency and tenacity which render them difficult to tear with the needles used for the preparation for the microscope. These bodies are formed: 1. Of fibro-plastic elements, whether nuclei or fusiform fibres; oval shaped cells are generally present, but not always. The nuclei are oval or spherical, generally very small—that is to say, they hardly exceed in diameter 0.008mm. to 0.009mm. The presence of these little spherical nuclei must be insisted on, because, with a less power than 550 diameters, it would be sometimes impossible to establish the differences which separate them from the elements of tubercle; the fusiform fibres are small and rare. 2. There exists a considerable quantity of amorphous homogeneous matter, in which minute granulations are scattered; it is very dense, and keeps the other elements strongly united together, so that it is difficult to isolate them completely. 3. Vessels are very rarely observed; the fibres of cellular tissue are also rare, or altogether wanting."

There being two microscopic elements, which are distinct from tubercular formations, but are liable to be mistaken for them, namely, shrivelled pus cells and plastic nuclei, more or less altered, it is seen, in part at least, why the older writers, and

some of a more recent date, like West, either hold that all meningitis is tubercular, or that there are comparatively few cases of the simple form.

On the other hand, there are cases of true tubercular meningitis, which, even with a pretty careful microscopic examination, might be and probably often have been, regarded as simple. The views of pathologists in reference to what is the primary form of tubercle, and what is and what is not tubercular matter, have recently undergone a great change. It is now believed that the tubercle cell is a round, pale, slightly granular cell, having from one to twelve nuclei; that it resembles considerably in appearance the normal cells of the lymphatic glands, being in the average somewhat smaller than the white corpuscles of the blood; that it is produced mainly from the nuclei of the connective tissue by proliferation; that it is vitalized like other cells, and, of course, has functional activity; that the true, the living cell, is found only in the so-called gray, semi-transparent tubercle. It is furthermore believed, that what has heretofore been considered the tubercle cell, namely, the irregular, sometimes angular, sometimes oval cell—without, indeed, any typical form—may be a dead, shrivelled, and altered tubercle cell, or a dead, shrivelled, and altered pus or other cell. If, therefore, such cells are found in the meshes of the pia mater, we cannot determine from the microscope their true character. We can only form our opinion in reference to their nature from concomitant circumstances, or from discovering in connection with them the true tubercle cell. Those products, which have been designated crude tubercle and tubercular infiltration, contain these shrivelled cells, or shrivelled nuclei; and they may have a tubercular origin, or, on the other hand, an inflammatory origin, without either tubercular deposit or diathesis.

In the tuberculosis of young children, I have found in a large proportion of cases in which I have had an opportunity to make post-mortem examinations, the tubercular matter disseminated through the lungs, and perhaps other organs, in small masses, many of them not larger than a pin's head, and some occurring as mere specks scarcely visible. These minute tubercular formations have ordinarily been semi-transparent and sometimes even transparent like minute drops of water, and containing the true, the living tubercle cell. Now if in such a case meningitis

occur, we may find the tubercle cell in or with the fibrin at the base of the brain. But failure to find it, even with protracted microscopic examination, does not prove its absence from this locality, for I consider it almost impossible to discover in the midst of the fibrinous exudation, such minute points of tubercular matter as are seen in the lungs, liver, or elsewhere. Moreover, if meningitis occur in tubercular patients without the presence of tubercles in or upon the meninges, it is probably due to the tubercular diathesis, just as inflammation and ulceration of the larynx occur in the adult affected with phthisis, although tubercle is never developed in this organ. For the above reasons, I have been led to consider meningitis tubercular, whenever tubercles were found in the lungs or elsewhere, and simple, if no such hetero-plastic formation were discovered.

The pia mater is often firmly adherent to the brain at the seat of inflammation, so that on raising it a portion of the brain may be detached and removed with it. Though the pia mater at the base of the brain is usually most involved in the disease, the inflammation in severe cases may affect this membrane, not only at the sides of the brain, but even at the vertex. There may indeed be pretty general inflammation of the pia mater. In cases of such extensive inflammation, the symptoms are apt to be severe, and the course of the disease rapid. Thus in the month of April, 1864, a girl eleven years of age, in the Protestant Episcopal Orphan Asylum of this city, had complained occasionally of dizziness, but was otherwise in good health, cheerful, and with excellent appetite, till Thursday, when she was affected with vertigo, more persistent than previously, and with headache. At 2 P.M. on the following day, she was seized with general convulsions, and she continued insensible or nearly so, with occasional convulsive movements, till Monday, when she died comatose. The pia mater at the vertex, sides, and base of the brain had a cloudy appearance, and underneath it, in places, was a thick creamy substance in small quantity, which, examined by the microscope, proved to be pus: the largest amount of pus was near the pons Varolii. There was no tubercle under the meninges or elsewhere, and no appreciable fibrinous exudation. The inflammation in this case was obviously intense. The only additional lesions noticed were moderate congestion of the brain, and an increase in the quantity of the cerebro-spinal fluid. In one case,

which occurred in my practice, there was fibrinous exudation at the superior surface of the hemisphere, and none at the base of the brain or elsewhere. There was no notable increase in the vascularity of the brain, but the amount of cerebro-spinal fluid in the ventricles, and exterior to the brain, was estimated at two ounces. The patient was a girl five years old, who had been accustomed to play bare-headed in the sun during the warmest part of the summer in 1844. The parents attributed her sickness to this cause, and hence the unusual location of the inflammation.

If the disease is protracted three or four weeks, which is rare, or even less time, the exuded substance may undergo further changes, such as occur in simple exudations in other parts of the system. Thus, on the 30th of April, 1860, we made the post-mortem examination of an infant at the Nursery and Child's Hospital, who had symptoms of cerebral disease, it was stated, for several weeks, but the exact time was not ascertained. Prominent among the symptoms referable to the cerebro-spinal system towards the close of life were the hydrocephalic cry and rigidity of the neck. The appearance at the autopsy was remarkable. The anterior half of the brain was completely encased in a deposit which had nearly the appearance of lard. It filled the fissures of Sylvius, and appeared slightly on the anterior aspect of the cerebellum. Examined under the microscope, this substance was found to contain numerous cells, among which could be distinguished some resembling pus cells, but nearly all had undergone more or less fatty degeneration. Here and there was seen a large cell containing numerous small oil globules, the compound granular cell of pathologists.

The brain itself in meningitis is usually injected. On making an incision through it, red points are seen upon the cut surface, which indicate the seat of the congested vessels. The inflammation rarely extends to the walls of the ventricles, but the choroid plexus is injected. In exceptional instances pus or fibrin is found in the lateral ventricles. In the infant two and a half weeks old, whose case has already been alluded to, about two ounces of purulent fluid escaped on opening the left ventricle. A small amount of liquid of a similar character was contained in the right ventricle. The distension of the lateral ventricles with serum is one of the most common results of meningitis. This fluid is clear

or straw-colored, or it is turbid in consequence of being mixed more or less with the softened brain substance. The quantity does not exceed two, three, or four ounces, and is often not more than one ounce or an ounce and a half. The distension of the two ventricles is ordinarily uniform, as they are united by the foramen of Monro, but now and then one ventricle is found more distended than the other. If there is considerable effusion the brain is compressed and the convolutions have a flattened appearance, unless the cranial bones are still separated so as to yield to the pressure. If the sutures and fontanelles are open, the cranial arch is expanded, sometimes quite perceptibly to the eye. From the same cause the anterior fontanelle, if open, is elevated. The foramen of Monro is enlarged according to the amount of effusion and the portions of the brain which separate the ventricles are sometimes lacerated. In many cases the brain substance surrounding the lateral ventricles is softened. The softening is found in all degrees, from the least appreciable deviation from the normal consistence to a state of diffidence, so that the brain presents the appearance of cream. Hypotheses have been advanced to explain the cause of this change in consistence, which are not entirely satisfactory. Whatever the explanation, the fact is attested by all observers, though there are exceptional cases. Thus Dr. West has records of the condition of the brain in fifty-nine cases, in thirty-seven of which there was considerable softening, and in the remaining twenty-two the consistence was normal.

CAUSES.—The causes of simple meningitis are not fully ascertained. Active cerebral congestion frequently occurring, is probably a common direct cause. I have known the inflammation in at least three instances to occur in infants from four to eight months old, who, a month or six weeks previously, had severe and protracted attacks of bronchitis. The disappearance of eruptions upon the scalp prior to the commencement of the inflammation, is a fact often observed. I have noticed this before the commencement of simple meningitis, as well as before meningitis, if not tubercular, at least occurring in a decidedly scrofulous state of system. I have sufficiently alluded to a case in which the inflammation affected mainly the pia mater at the vertex, and which apparently resulted from frequent exposure in the months of August and September bare-headed to the sun's rays.

The cause of tubercular meningitis need not detain us. It is sufficiently dwelt upon in the foregoing pages.

PREMONITORY STAGE.—Meningitis is usually preceded by symptoms which, if rightly interpreted, are of the greatest value. In most cases of both the simple and tubercular forms, which I have seen, there was a prodromic period, varying from a few days to as many weeks. The symptoms of this period are obscure, and are apt to be mistaken for those of other and distinct affections.

The child in whom meningitis is approaching, loses his accustomed vivacity and cheerfulness. He has a melancholy and subdued appearance, being quiet for a few minutes and then fretful, without apparent cause. He can sometimes be amused by his playthings or companions for a brief period, when he turns from them with evident displeasure. Unexpected and loud noises and bright lights are evidently painful. If old enough to describe his sensations, he complains of transient dizziness and at other times of headache. His ill-humor, if his wishes are not immediately gratified, or if they are denied, are often scarcely endurable on the part of friends who are ignorant of the cause. There is great difference, however, in different cases as regards this symptom. Some are inclined to be taciturn and quiet, while others are almost constantly fretting. The appetite is capricious; at one time it is pretty good; at another it is poor or even entirely lost. The patient may take a few mouthfuls of food, or if an infant, nurse for a moment, when his hunger appears satisfied, and he will take nothing more. The bowels are regular or inclined to constipation. The pulse is natural, or it has times of acceleration, especially in the latter part of the day and towards the close of the premonitory stage. The duration of this stage is very different in different cases. Upon an average it is perhaps about two weeks, but it is often longer. In tubercular meningitis the symptoms both during the inflammation and previously, are apt to be complicated by those which arise from tubercles in other parts of the system.

Unless the prodromic period is of short duration, the effect of imperfect nutrition is obvious before it closes. The flesh becomes soft and flabby, or there is actual emaciation though generally slight. The patient loses his strength, becoming less able to stand or to walk, and more easily fatigued. Occasionally, especially in

the simple form, premonitory symptoms are absent, or are slight and of short duration.

SYMPTOMS.—Dr. Whytt, living in the last century when the tendency was rather to refinement in classification than to simplicity, divided meningitis into three stages, according to the symptoms, especially the pulse. Many subsequent writers following Whytt's example, have recognized three stages, based not upon the anatomical character of the disease but upon the succession of symptoms. Such division of meningitis is in great measure arbitrary, since in one case the same symptom occurs at an earlier period than in another.

When the premonitory stage has passed and inflammation is developed, some of the symptoms which were previously present remain, and are intensified and other new and more characteristic symptoms appear. There are now fewer intervals of apparent improvement. The child is quiet, often lying with its eyes shut. If aroused, he has a wild expression of the face, and is irritated by attempts to engage his attention or amuse him. He rarely smiles, or takes his playthings, or he notices them for a moment, when he turns away with disgust. During sleep there is often at first a placid expression of contentment; but when aroused he has the aspect of real sickness; the eyebrows are sometimes contracted, as if from headache; the features wear a melancholy look, and are turned away to avoid the gaze of the observer or to shun the light. If the anterior fontanelle is open, it is observed to be prominent and pulsating forcibly. If consciousness is not lost and the patient is of sufficient age, he complains of headache or of pain in some part of the body. The tongue is moist and covered with a light fur; the appetite is lost or poor; there is seldom much thirst; more or less nausea and constipation are present. As the inflammation continues, and usually within three or four days from its commencement, symptoms arise which dispel all doubts, if there were any, as to the nature of the disease. The vital powers are now evidently beginning to yield. The surface generally is more pallid, and there is the curious phenomenon of the sudden appearance, and, after some minutes, disappearance of spots or patches, or even streaks of active congestion upon the face, forehead, or the ears. These, having a bright red color, contrast strongly with the general pallor. Ordinarily they are irregularly circular or oval, and from one inch to an inch and a half in

diameter. A red spot or streak is also produced if the finger is pressed upon the surface or drawn forcibly across it. It continues a few minutes and then gradually fades. Trousseau calls attention to this fact as a diagnostic sign.

Another curious phenomenon is the variation in temperature. The face and limbs at one time feel quite cool, and, after some minutes, without any excitement or other appreciable cause, the temperature rises, so that the surface is warm to the touch.

Consciousness, in severe cases, may be lost at an early period. On the other hand, I have known it in a case of moderate severity to remain, though partially obscured till within twenty-four or thirty-six hours of death. The patient will usually open his mouth for drinks, which are placed to his lips, when there is no other evidence of intelligence, and when sight and hearing are evidently lost.

The loss of the senses constitutes an interesting, but melancholy feature of the disease. Among the first unreciprocal symptoms, and frequently the very first, are such as pertain to the eye. This organ should be watched from day to day when the diagnosis is uncertain. Deviation from its normal state affords evidence of meningitis. The pupils are seen to dilate or contract sluggishly by variations in the intensity of the light, or they are not of the same size with those of another individual to whom the same amount of light is admitted. Sometimes the first perceptible deviation from the normal state is an inequality in the size of the pupils; while, in others, oscillation of the iris is observed. At a later stage, not generally till convulsions have occurred, the parallelism of the eyes is lost, and in most patients they have an upward direction. After effusion has occurred, the pupils are commonly dilated. As death approaches, the eyes become bleared, and a puriform secretion collects in the inner angle of the eye, and between the eyelids. This secretion is not abundant, but it is sometimes sufficient to unite the lids. The sense of hearing is probably lost, as soon, or nearly as soon, as that of sight, but the sense of touch continues longer. The tongue is covered with a moist fur, unless near the close of life, when it is sometimes dry. The appetite is gradually lost, but often drinks are taken with apparent relish, even when there is no other evidence of consciousness. There are two symptoms pertaining to the digestive system which are rarely absent, and which possess

great diagnostic value; one is vomiting, the other constipation. In some patients irritability of stomach begins at so early a period that it is really prodromic; it is rarely absent. Barrier collected the records of eighty cases of meningitis, in seventy-five of which this symptom was recorded present. It is due to the intimate relation existing between the stomach and brain, through the ganglionic system of nerves. The vomiting occurs without effort, and usually at intervals, for several days. It is a sudden ejection of the contents of the stomach, apparently without preceding or subsequent nausea. It contrasts, therefore, with the vomiting due to an emetic, which is attended by distressing symptoms. With some it occurs frequently; with others not more than two or three times daily. Commencing in the first stages of meningitis, or even prior to it, it occurs less often as the drowsiness becomes more profound, and finally ceases. Constipation is also present, usually from the commencement of the disease. It is one of the most constant and persistent symptoms, continuing through the entire sickness, unless relieved by medicine, or unless there is a coexisting diarrhoeal affection. Often, when diarrhoea precedes the meningitis, it ceases the moment the latter commences. The constipation in this disease is easily overcome by purgatives. Several writers speak of retraction of the abdomen as a sign of meningitis. A hollow or sunken appearance of the abdomen, according to Guislis, aids in distinguishing meningitis from fever. The anterior abdominal wall approaches the spine, so that the pulsations of the abdominal aorta are distinctly felt. Killiet and Barthex, who have rarely observed this retraction except in cerebral diseases, attribute it to the state of the intestines rather than to the action of the abdominal muscles.

The pulse in the first stages of meningitis is accelerated, or it is nearly natural during certain hours and afterwards accelerated. When the disease has continued a few days, often not more than three or four, the pulse undergoes a marked change. It becomes slower and at the same time irregular. The irregularity usually consists in an intermittence of the pulse after six or eight beats. Sometimes the force of the pulsation varies, so that a feeble pulsation is succeeded by one of greater volume and force. The decrease in the frequency of the pulse cannot fail to arrest attention. From 110 or 120 beats per minute in the first stage of the inflammation it often descends to a frequency even less than the normal

adult pulse. At an advanced period, as death approaches, the pulse again becomes accelerated and feeble.

The change in respiration is as decided as that of the pulse. In the beginning of the meningitis respiration is sometimes moderately accelerated, but in other cases it is natural. When the disease has continued a few days, the time usually varying from three or four to more than a week, a marked alteration occurs in the respiratory movements. Their rhythm, like that of the pulse, is disturbed. The breathing is irregular, intermittent, and accompanied by sighs. This change in pulse and respiration corresponds with the loss of consciousness, and shows that the brain is becoming seriously affected.

When the pulse and respiration undergo the changes which have been described, another prominent and grave cerebral symptom is often present, namely, convulsions. Its occurrence diminishes greatly the prospect of a favorable issue. The severity and extent of the convulsive movements vary in different cases. They may be partial or general. Their duration is often brief, but they recur three or four times through the day. They are preceded by cephalalgia in those old enough to express their sensations, and often by drowsiness. Each convulsive attack ends in still greater drowsiness.

With this group of symptoms another should be mentioned. I refer to the hydrocephalic cry. At intervals the patient, without being disturbed, and without any change in symptoms, utters a scream or sharp cry, and immediately relapses into his former state. This cry is more common in the first stages of the disease than subsequently, and in some it is absent or is not a marked symptom. The glandular system participates in the general loss or derangement of function. Tears are seldom shed, even when the child is much irritated, and the urinary secretion is greatly diminished. The small amount of urine passed sustains an important relation to the progress of the disease and the therapeutics.

The patient usually lingers several days after the pulse and respiration are changed in the manner stated. The drowsiness becomes more profound, the vomiting ceases, as well as the convulsive attacks, and sensation and consciousness are entirely lost. But even in this state, if nutriment and stimulants are administered with regularity, the child often lives several days longer than the friends believed to be possible. At length increasing

feebleness and rapidity of pulse and coldness of the face and limbs indicate the near approach of death, which occurs in a state of coma.

The symptoms described above are such as occur in ordinary cases of meningitis, and in the order which I have indicated. But he will be disappointed who expects that the above description will apply to all cases.

Meningitis may be so violent and rapid that both the character and succession of symptoms may be different from those which have been stated. Thus, I have related the case of a girl, who, with no prodromic stages excepting occasional dizziness and slight headache, was taken sick on Thursday, had convulsions on Friday, and from this time continued either in convulsions or coma till her death on Monday. Again, even in cases of the usual duration and anatomical character, some of the most prominent symptoms upon which we rely for diagnosis may be lacking. The following is an instructive case of this kind:—

CASE.—On the 1st of April, 1862, I was asked to see a boy two years and eight months old, of healthy parentage, and who, during the preceding year, had been in uniform good health, but previously had had two or three severe attacks of sickness. His head was of large size, and whenever much indisposed he usually had symptoms premonitory of convulsions, which were always, however, prevented.

One night, in the latter part of March, his parents noticed that his sleep was restless, but on the following day he seemed entirely well, and the restlessness at night was attributed to a late and hearty supper. On succeeding nights, however, he was restless, and, when questioned, complained of pain in the abdomen. In a few days he was observed to be drooping in the daytime, and his appetite was not quite so good as previously. He had continued in this way about a week when my first visit was made.

The abdominal pain had at this time become more constant, but was never severe or accompanied by vomiting. When asked where he felt sick, he placed his hand upon the epigastrium; pressure upon epigastrium sometimes tolerated, at others times painful; tongue moist, and covered with a thin and whitish fur; anorexia, thirst, constipation, scantiness of urine, no headache, or unusual heat of head in any part of his sickness. He vomited at intervals from about the seventh to the tenth of April, when the irritability of stomach ceased, and there was no return of this symptom.

About April 7th, the respiration was first observed to be irregular, and sighing and the pulse intermittent. These, so tardily developed, were the first symptoms indicative of cerebral disease. He now lay most of the time in bed with eyes closed, surface commonly pale, with occasional rose-colored spots or patches upon the cheek or forehead. The pupils responded to light in the usual manner till

near the close of life, but bright lights were painful; the last two or three days of his life the left pupil was more dilated than the right. He had no convulsions or the least spasmodic movement, and was conscious till within a few hours of death; the mother states that there was unequivocal evidence of his recognition of her on the last day of his life. He died April 17th, nearly three weeks after the commencement of the disease, and ten days after the commencement of symptoms which were distinctly referable to the cerebro-spinal system.

Autopsy.—Abdominal organs healthy, though epigastric pain had been so constant and prominent a symptom; brain and its meninges somewhat injected. The meninges covering the base of the brain from the most prominent part of the pons Varoli to the first pair of nerves, presented evidences of inflammation. There was such opacity of the pia mater in places, as to conceal the brain from view. The anterior and middle lobes of each hemisphere were glued together by fibrinous exudation, and on the left side along the fissure of Sylvius was a thick deposit of the same character. The lateral ventricles contained about an ounce of clear serum, and about half an ounce escaped from the base of the brain. The foramen of Monro was considerably enlarged, and the brain substance surrounding the lateral ventricles was, perhaps, somewhat softened, but not in a notable degree.

In this case it is seen that the prominent symptom, and, indeed, almost the only marked symptom in the first stages of the disease, was pain in the abdomen, and yet the abdominal organs were healthy. At the very moment when it was highly important that a correct diagnosis should be made, the evidences of cerebral disease were lacking. This case is chiefly interesting on account of the variation in symptoms from those in the usual form of meningitis. There were no convulsions, and consciousness was retained as well as vision till near the close of life, and yet the lesions were such as are commonly present in meningeal inflammation. In such cases a wrong diagnosis is apt to be made to the injury of the patient, and the reputation of the physician.

Occasionally meningitis may continue so long as to almost justify its being called chronic, even when the exudation in the meshes of the pia mater is extensive. In meningitis which terminates favorably, there is a gradual subsidence of symptoms. I shall describe more fully this termination in speaking of prognosis.

Diagnosis.—It is of the utmost importance to diagnosticate meningitis in its first stages, for treatment to be successful must be commenced early. Some writers describe at length the means of diagnostivating the simple from the tubercular form of the dis-

case. Differential diagnosis is often difficult, and sometimes impossible, but it matters little practically whether the form of the disease is ascertained. On the other hand it is very important, in order that the treatment be appropriate, to diagnosticate the premonitory or initial stage of meningitis from certain other affections not located within the cranium. Sometimes remittent or continued fever or constitutional disturbances arising from irritation in the digestive system, simulate closely incipient meningeal disease, so that the greatest care and discrimination are required in order to make a correct diagnosis. Within a comparatively recent period I have known, in three different instances, experienced physicians of this city mistake commencing meningitis for fevers, not aware of the serious error they had made till the inflammation had reached a stage from which recovery was impossible. In order to make a correct diagnosis in the premonitory or initial stage of meningitis, the physician should take time to observe the physiognomy, and note every symptom. More than one protracted visit is often required to remove all doubt as to the exact pathological state.

Meningitis is usually preceded and in its commencement accompanied by greater restlessness, fretfulness, intolerance of light, and greater variation of symptoms than most other diseases. One familiar with the physiognomy of infancy and childhood, will discover in the features indication of greater suffering, of more serious sickness than is commonly present in other and distinct affections whose symptoms are similar.

Sometimes the sudden disappearance of a chronic eruption upon the scalp will aid in the diagnosis. This is a sign of importance taken in connection with the symptoms. Headache and vomiting, symptoms of early occurrence, should especially arrest attention, or in absence of headache, pain of a neuralgic character in some other part. If there is doubt at first, careful and repeated examinations, if we are familiar with the various signs and symptoms of meningitis, will soon remove all uncertainty. When the eyes become affected, the respiration and circulation irregular, and especially when convulsive attacks begin, diagnosis is easy. In fact an incorrect diagnosis would then be unpardonable, but unfortunately if proper treatment has not been commenced till this period it will be of little service.

PROGNOSIS.—Meningitis is one of the most fatal diseases of early

life. Whether the form is simple or tubercular, if the initial stage has passed without proper treatment, death may be considered inevitable. Tubercular meningitis, however early recognized, is rarely amenable to treatment. M. Guersant (*Dict. Med.*, t. xix. p. 463) believes that recovery from the first stage of tubercular meningitis is possible. "In the second stage," says he, "I have not seen one child recover out of a hundred, and even those who seemed to have recovered have either sunk afterwards under a return of the same disease in its acute form, or have died of phthisis. As to patients in whom the disease has reached its third stage, I have never seen them improve even for a moment." The very few reported cases which resulted favorably may have been, as M. Guersant has intimated in the context, cases of the simple form. Rilliet and Barthéz believe that in a few instances tubercular meningitis has been cured in its first stages, but they state also that the disease is apt to return.

The prognosis in simple meningitis is not so unfavorable, provided treatment is commenced at a sufficiently early period. It is now generally admitted that the simple form may not infrequently be averted, when threatening, and even arrested in its incipency. In many such cases we cannot, from the nature of the disease, be certain that the diagnosis is correct. But when we see children relieved, who present precisely those premonitory and even initial symptoms, which occur in meningitis, we must believe that at least some of them would have had the genuine disease if not relieved by the measures employed. That recovery is possible from simple meningitis in its commencement, is also obvious, from the fact that a few recover even from the advanced stage when there can be no error of diagnosis.

I have known but two recoveries from meningitis when it had continued so long and had reached that degree that the function of the brain and cranial nerves was impaired. One of these recovered with the permanent loss of sight, the other with the loss of hearing. Both seem to have ordinary intelligence. Another case has been communicated to me, in which the patient, a little girl, recovered completely, but for several months after the attack seemed nearly idiotic.

Sometimes even in the second stage of meningitis, treatment properly employed is attended by amelioration of symptoms. Though such improvement may serve to encourage physicians

und fricula, it should not be the basis of a favorable prognosis unless it continue three or four days.

Apparent improvement during a few hours or a considerable part of a day, is not unusual in those who finally die. Thus, in an infant whose bowels were previously constipated, I have known the pulse and respiration to become more regular and the symptoms generally improve, though only for a brief period by the action of a purgative. Dr. Watson says of the advanced stages of this disease, it is "often attended with remissions, sometimes sudden, and sometimes gradual, deceitful appearances of convalescence. The child regains the use of its senses, recognizes those about him again, appears to his anxious parents to be recovering, but in a day or two it relapses into a state of deeper coma than before. And these fallacious symptoms of improvement may occur more than once."

Most fatal cases of meningitis terminate between the third or fourth and the twentieth day, the duration varying according to the extent and intensity of the inflammation, and the vigor and age of the patient. But there are cases in which it may continue much longer. It is surprising sometimes how long the patient lives, when the symptoms are such that death seems impending. Sensation and consciousness may be extinguished, convulsions occur at intervals, and the surface have acquired almost a cadaveric aspect, and yet the patient lives on. Killiet and Bartholin say, "Often have we inscribed upon our notes death imminent, and been astonished the next day to find still alive children to whom we had expressly allowed two hours of life." The symptom which I have found to be the most reliable prognostic of the near approach of death, has been a pulse gradually becoming more frequent and feeble, though other symptoms remain as before. This change in the pulse is usually very apparent during the last twenty-four hours of life.

TREATMENT.—Such remedial measures should be prescribed during the premonitory stage as are calculated to relieve the fretfulness or irritability of temper, and quiet the action of the brain, and, at the same time, produce a derivative effect from this organ. To this end the patient should be kept from all causes of excitement, and the bowels should be opened daily, if not naturally, by the use of proper medicines. A mustard foot-bath at night and occasionally through the day is useful, as it produces both a

derivative and soothing effect. It will commonly produce a few hours' undisturbed rest, while all other measures except opium fail. If dentition is taking place and the gums are swollen, it is sometimes proper to scarify them. This operation, by diminishing the swelling and tenderness, may diminish the irritability of system. In most cases in which there are symptoms threatening meningitis moderate counter-irritation behind the ears is required. The fact that the disease sometimes follows the recession of cutaneous eruptions of the scalp shows the importance of this remedy; but it is not advisable to produce counter-irritation over a large surface, since this may increase the restlessness of the child, and aggravate rather than relieve the state of the head. West says: "Another inquiry that you may put is, when are you to employ blisters? Certainly not at the beginning of the disease, when they would increase the general irritation, and do more harm than good. At a later period they may be of service, when the excitement is about to yield to that stupor which usually precedes the state of complete coma. They should then be applied to the nape of the neck or to the vertex." Vesication produced at so late a period as Dr. West recommends, can produce little effect in arresting the disease; besides counter-irritation at the vertex, or back of the neck is too far removed from the seat of the disease. I have never known it when employed in the manner which I shall advise to increase the restlessness. I have many times prescribed vesication, sometimes when the symptoms passed off and there was restoration to health; at other times, when meningitis supervened with its usual result, and I have never regretted the prescription. Cantharidal collodion applied with a brush answers the purpose, and from its convenient application is to be preferred. It does not vesicate deeply, or produce a troublesome sore.

Many children who are threatened with meningitis are scrofulous. They have already shown symptoms of tubercular disease. They are, perhaps, to a certain extent emaciated, and may have been affected with a cough. The premonitory symptoms in these children, indicate the approach of the tubercular form of meningitis, and a more sustaining course of treatment is required than in those who are robust. To such children, cod-liver oil may be profitably given, three times daily, together with the syrup of the soluble of iron, or iodide of potassium. They should also be taken into the open air, with proper precautions, and every hygienic measure

should be employed which will be likely to invigorate the system without exciting the brain.

Loss of blood is not, in general, required during the prodromic period, nor in the disease. Those of a strumous cachexia, or those whether strumous or not, who are under the age of two years, do not, unless in very rare instances, require depletion by leeches, much less by venesection. There is one class of patients in whom the early loss of blood may, doubtless, be of service, namely, those who in a state of robust health are suddenly seized with the inflammation. Leeches should then be applied to the head of the patient if he is seen at an early period.

The propriety of using opium to allay irritability of system in those threatened with meningitis, is viewed differently by physicians. Bouchut says: "Opiates have the inconvenience of increasing constipation, but they are very useful in calming the state of cerebral excitement of young infants. Laudanum should be given in a draught in a narcotic dose, at short intervals, gradually increasing the dose of it until sleep is obtained." If the restlessness is not allayed by the measures which have been recommended above, the careful use of an opiate will be beneficial. I would prefer a small dose of Dover's powder or syrup of peppies. Half to three-quarters of a grain of the former, or a drachm of the latter may be given to an infant one year old.

Often notwithstanding the measures employed, the patient grows worse, the symptoms become more continuous, others more alarming arise, and meningitis declares itself. For internal treatment, there are two medicines which are extensively used, by the profession, in fact, to the exclusion of nearly all others, the one calomel, the other iodide of potassium. Those who employ the iodide as the main remedy commonly, also, prescribe single doses of calomel occasionally, as an eligible purgative when there is constipation, so that half a dozen or more doses may be given in the course of the disease. By those who depend upon calomel as the main remedy, it is given not only to keep up a relaxed state of the bowels, but also in the belief that it arrests the exudation from the meninges. These last give it daily in small doses.

My observations have not been favorable to the use of calomel, except as an occasional purgative. When administered daily, it has a very depressing effect, and it is to be recollected that this is a disease in which the vital powers rapidly sink, in consequence

of the loss of appetite and the frequent vomiting. In tubercular meningitis, it is obvious that any remedy which greatly reduces the strength may increase the tubercular deposition, and thereby diminish the chances of recovery. Cases have occurred in which calomel was given at short intervals for several successive days, and though the meningitis seemed to be relieved, death resulted from sheer exhaustion, or from some intercurrent affection, the result of exhaustion, or of the remedy. In one case related to me, fatal gangrene of the mouth, the result of the mercurial treatment, supervened after the meningitis had apparently subsided. Unless, therefore, statistics show that a larger proportion recover by the use of calomel than by iodide of potassium, we should prefer the safer agent. Now, while many recover who exhibit symptoms which are premonitory of meningitis, and a few from meningitis itself, by the use of iodide of potassium, restoration to health by the calomel treatment is certainly very rare, if there are unequivocal evidences of meningeal inflammation. Dr. Whytt, who lived in the time when calomel and loss of blood were commonly prescribed not only in this but in other diseases, never saw a favorable case. Moreover, physicians of the present time incline more and more to the use of iodide of potassium and the rejection of calomel as the main remedy.

The iodide of potassium should be given as early as possible in the premonitory period. If, by a careful examination, the absence of any other local disease or of a constitutional affection which might give rise to similar symptoms is ascertained, this agent should be immediately prescribed. The symptoms at this early period are often so obscure that a positive diagnosis cannot be made; but it is better to give the iodide even if the diagnosis is wrong, and no meningeal disease is threatening, than to err on the other side and withhold its use in the prodromic and initial period of the true disease. An infant from six to twelve months old should take two grains every two hours, and older children a proportionate dose. Larger doses may in some cases be administered. When thus given, the iodide soon produces an impression on the system, and especially on the renal secretion; the quantity of urine, previously scanty, becomes largely increased. If with the regular and continued use of potassium there is no improvement, the case is without remedy.

Throughout the disease as well as in its commencement, the

Sulphate of potassium should, therefore, be employed until it is obvious that there is no chance whatever of improvement, when medication may properly be discontinued. Adjuvant medicines are of little service, with the exception of an occasional laxative dose to relieve constipation. Anti-emetics for the vomiting, and anti-spasmodics for the convulsions, with the exception of chloroform, which is hardly admissible, have but little effect. The apartment should be dark and quiet; a moderate degree of vesication should be produced behind the ears, and the head be kept cool. In simple meningitis occurring in children three or four years of age or older, previously healthy and robust, it is proper to place a bladder with pounded ice over the head, separated perhaps by two or three thicknesses of muslin, provided that the temperature is elevated as it ordinarily is. If there is not much heat, or if the child is considerably prostrated, a cloth wrung out of cool water will be sufficient. Bouchut recommends irrigation, and condemns the mode of applying cold which is recommended above. Says he, "Refrigerants external to the cranium are often employed, and their use appears very rational; still they do not possess a very great efficacy. The application of compresses moistened with cold water, ice in a bladder and laid on the forehead, are bad remedies, which, by causing too considerable alternations of heat and cold, are rather noxious than useful to the child. If it is wished to employ refrigerants, recourse should be had to continual irrigation. The patient is not to be disturbed in its bed; the head should be placed on a cushion, the hair being cut very short; the neck is bound moderately tight by an impermeable stuff, so placed on each side as to form a gutter, so that the water which has been used in the irrigation can run off from each side of the bed without wetting the body of the child. Having arranged these, a jar filled with water of a moderate temperature, 64° Fahr., is placed above the patient; a siphon with a tap is to be placed in the jar to moderate at will the flow of the liquid. To this tap is fastened a skein of loose thread, for the purpose of conducting the water to the forehead, so as to avoid the continuous dropping of the liquid, which would be insupportable." If, however, there is an attentive nurse, who renews the wet cloth sufficiently often, there does not seem to be any danger from reaction, as feared by Bouchut. Irrigation requires no constant attention, in consequence of the restlessness of the

child, as does the treatment by wet clothes, in order that there be no interruption in the employment of it. Few children will remain quiet with a descent of water upon the head, except those who have become entirely insensible, and in such neither wet clothes nor irrigation affords any material benefit. In simple meningitis in its first stages, the diet should be mild and rather scanty; in the tubercular form it should be more nourishing; beef-tea and milk porridge are required. In both the simple and tubercular form at an advanced stage, the most nourishing food is required, but stimulants should not be given unless near the close of life when the vital powers are failing.

CHAPTER X.

SPURIOUS HYDROCEPHALUS.

THE disease designated spurious hydrocephalus might with more propriety be called spurious meningitis. It received its appellation at the time when meningitis of early life was believed to be essentially a hydrocephalus, and was so called. Attention was first directed to this affection by London physicians of the last generation, particularly Drs. Gooch, Abercrombie, and Marshall Hall, and little can be added to their description of its symptoms.

ANATOMICAL CHARACTERS.—This disease, though resembling meningitis in certain of its phenomena, is not in its nature inflammatory, nor is it primary. It is the result of some affection often chronic, but occasionally acute, which has produced exhaustion, especially of the nervous system. When it commences there is usually more or less emaciation, and the symptoms of the primary disease are present. To this disease pertain also the lesions, which are found in other organs besides the brain.

The state of the brain in spurious hydrocephalus is not the same in all cases. In some there is no appreciable anatomical alteration in this organ. There is no apparent difference either in the meninges or the brain itself, from the condition which we often observe in those who have died of diseases which do not

affect the cerebro-spinal system. In such cases the pathological state is simply deficient innervation, or if there is a structural change in the minute anatomy of the brain, pathologists have not yet discovered it.

The following case, which occurred in the the Childs' Hospital of this city, is an example of this form of spurious hydrocephalus:—

CASE.—A female infant, six months old, died on the 24th day of April, 1862, with the following history: It was well-nursed, fleshy, and apparently well, till six days before death, when symptoms of gastro-intestinal inflammation were suddenly developed. The vomiting especially was severe, continuing forty-eight hours. When it ceased, drowsiness supervened, and continued till the close of life. The face during the four days of stupor was pallid and cool; eyes partly open, pupils sluggish, but of equal size; bowels rather torpid, anterior fontanelle depressed. When aroused the infant noticed objects for a moment, and immediately relapsed into sleep; pulse accelerated and not intermittent, the day before death numbering one hundred and fifty; respiration accelerated without sighing, numbering on the same day thirty. There were no convulsions, and death occurred quietly. The brain weighed twenty and a half ounces, and its appearance was perfectly healthy, both as regards consistence and vascularity. The amount of cerebro-spinal fluid in the ventricles and at the base of the brain was not notably increased. The stomach, small and large intestines were vascular in streaks and patches.

In this case the cerebral symptoms were obviously due to exhaustion occurring at an early period, in consequence of the severity of the gastro-intestinal affection.

In a majority of cases, however, of spurious hydrocephalus, according to my observation, there is an anatomical alteration in the state of the brain and meninges. This consists in passive congestion of the veins with more or less serous effusion. At the same time the cranial sinuses are congested, and are found at the post-mortem examination to contain larger and more numerous clots than are present in those, who die of diseases which do not affect the encephalon. Cases might be cited as examples. The cause of this congestion and effusion is, in great measure, feebleness of the circulation due to the general exhaustion of the patient. But there is another cause. In protracted diseases, especially those of a diarrhoeal character, there is more or less wasting of the brain as well as of other parts. This naturally, by way of compensation, gives rise to congestion of the cerebral veins and to serous effusion.

The serous effusion commonly occurs in this disease over the superior surface of the brain and in the subarachnoidal space, perhaps also more or less in the lateral ventricles. So common are congestion and effusion in the last stage of infantile enterocolitis, the summer epidemic of the cities, that this stage which is really spurious hydrocephalus, has been called the stage, of effusion. I shall relate in another place examples, which show the anatomical characters of this intestinal disease.

SYMPTOMS.—Spurious hydrocephalus most frequently results from protracted diarrhoeal complaints. It may, however, result from any disease which is attended by great prostration. As it ordinarily occurs, the patient has for days or weeks been gradually losing flesh and strength. Finally drowsiness supervenes, or before the drowsiness there is sometimes a stage of irritability.

Marshall Hall describes two stages of spurious hydrocephalus. In the first, he says, "The infant becomes irritable, restless, and feverish; the face flushed, the surface hot, and the pulse frequent; there is an undue sensitiveness of the nerves of feeling, and the little patient starts on being touched, or from any sudden noise; there are sighing and moaning during sleep, and screaming; the bowels are flatulent and loose, and the evacuations are mucous and disordered." The second stage he describes as that of torpor. The first stage often, however, does not present those prominent symptoms which have been described by Dr. Hall, and this stage may even be absent, or not appreciable, especially in young infants.

Whether or not commencing with the stage of irritability, the disease, if not checked, gradually increases. The child soon becomes drowsy. It may be aroused for a moment, but unless constantly disturbed it relapses into sleep. It is sometimes fretful when aroused, but at other times it seems quite indifferent, observing without apparent interest objects employed for the purpose of rousing it. There is evidence of pain or distress in the head, but many of those affected are too young to make known their sensations. Convulsions sometimes occur toward the close of life, but they are not so common in this disease as in meningitis. When they do occur, they are generally partial and often slight. The pulse is usually accelerated prior to and in the commencement of spurious hydrocephalus. As the disease advances it becomes irregular and intermittent, and towards the close of life

it is progressively more frequent and feeble. The respiration, at first, is not much disturbed, but it at length becomes irregular like the pulse. It is feeble and accompanied by sighs. Occasionally there is slight cough. The eyelids are partly open, the pupils no longer respond to light, and in advanced cases, they have a bloated appearance. The diarrhoea, which in most instances precedes and causes the disease, continues till the stage of stupor arrives, when the evacuations become less frequent or cease altogether. In infants the stools are frequently green, in older children brown and sometimes slimy. The febrile heat of surface, which preceded the disease and was present in its commencement, disappears; the face and hands become cool, the features pallid, and the anterior fontanelle, if open, is depressed. Death finally occurs in a state of coma, or, if the disease is recognized and proper remedial measures employed, the result may be favorable, even when the symptoms are such that if they occurred in the meningeal inflammation we would consider the case necessarily fatal.

The following case is an example of spurious meningitis as we often meet it in practice:—

CASE.—On the 13th day of March, 1839, I was asked to see a male child twenty-two months old, the records of whose case are as follows:—

"Was well till about three weeks ago, since which time he has had diarrhoea, with febrile symptoms; pulse 162, respiration 52; has a slight cough, with a few mucous rales; resonance on percussion of chest good; is somewhat emaciated, and appears languid; tongue moist and slightly furred. Has all the incisor and three anterior molar teeth, and the gum is swollen over the remaining anterior molar and two canine teeth."

From the 14th to the 18th there was no material alteration in his symptoms, with the exception that the diarrhoea was partially restrained by Dover's powder in one and a half grain doses. On those five days the dejections numbered daily from one to six. The pulse was uniformly frequent, varying from 124 to 156, and the respiration on two days, when its frequency was ascertained, numbered 56 and 48.

"March 18th, pulse 124; has become drowsy since yesterday, and when aroused is fretful. Omit Dover's powder. Treatment, cold applications to the head, mustard pediluvia.

"Evening, pulse 136; eyes constantly closed and head reclining; surface generally warm; tongue dry and furred; vomited at first, but has not in three or four days. Apply cantharidal collodion behind each ear, and continue the local treatment.

"20th, pulse 136, is constantly sleeping, and when aroused is very fretful and soon relapses into sleep; no unnatural heat of head and

no defecation since yesterday. Treatment, a dose of castor oil, nourishing diet.

"21st, drowsiness as before; cheeks sometimes flushed, sometimes pale; pupils sensitive to light; margins of eyelids covered with secretion. The bowels have been opened by the oil."

On the 22d and 23d there was no material change in the symptoms. He was constantly sleeping, except for a moment when shaken. More active stimulation was now employed. Brandy was prescribed, to be given every two hours; beef-tea and milk porridge frequently.

On the following day, the 24th, he was more fretful, and less drowsy. Brandy and beef-tea were continued.

On the 25th, with the same treatment, there was still further improvement; drowsiness nearly gone and less fretfulness than yesterday; rolls the head occasionally and does not appear to see distinctly; has a slight cough; bowels nearly regular; pulse 140; respiration natural; surface warm, and no unusual heat of head. The same treatment was continued and he rapidly and fully recovered.

This case is interesting on account of the long duration of marked drowsiness, which continued five days, and yet the patient recovered fully in the space of two or three days under the use of brandy and beef-tea.

In May, 1869, I was called to treat a very similar case. A child, twenty months old, had diarrhoea for two weeks, the stools being of a dark-brown color, thin and offensive. He was at first very irritable. The pulse was constantly above 130, and the respiration was correspondingly increased. The stage of drowsiness finally supervened, and for two days he was constantly asleep unless aroused by being shaken. During the somnolent stage the pulse numbered 140, respiration 36. The face and extremities were cool, and he finally had a slight convulsion. By stimulants and nutritious diet he began immediately to improve, and was soon out of danger.

In the following case the result was unfavorable. This case is interesting on account of the anatomical characters of the disease as disclosed by the post-mortem examination. It is an example of that large class of cases in which spurious hydrocephalus is associated with congestion of the cerebral vessels and serous effusion. It is exceptional, however, as regards the long duration of drowsiness. Ordinary protracted diarrhoeal maladies which end in congestion and effusion, terminate fatally in two or three days after the drowsy period arrives.

CASE.—"Dec. 13th, 1841, called to-day to a German infant eighteen months old. It has had diarrhoea four weeks without regular and

proper medical attendance; stools from the first brown and thin; during the last eight or nine days has been drowsy; when aroused opens his eyes and is very fretful, but immediately the upper eyelids gradually droop, and unless disturbed he remains asleep with his eyes partially open; forehead warm, face cool and pallid, and limbs also rather cool; pulse 164, respiration 32; has had a slight cough about one week, and slight dulness on percussion over the left infra-scapular region; depression of infra-mammary region on inspiration. Treatment: *Anticarb.* gr. i every two hours; nourishing diet.

"Dec. 26th, has continued drowsy since the last record; pupils moderately dilated; a thick secretion between eyelids; right pupil considerably larger than the left; vision apparently lost during the three last days; pulse over 140; respiration 44 per minute, accompanied by sighing since the 18th; moans much when awake; rolls the head frequently; during the last six days the surface back of the ears has been constantly sore by vesication; takes the most nutritious diet, with brandy. The dejections remain thin and brown, and number three or four daily.

"From this date the diarrhoea continued except as it was restrained by vegetable astringents. The pulse continued frequent, and a slight cough remained. There was on the 21st and 22d partial abatement of the drowsiness, but on the 23d it was greater than ever. The body was somewhat reduced at the commencement of the cerebral symptoms, but it was now considerably emaciated. The prostration increased daily, and the hands were observed to tremble. The face and hands became more cold, while the head was warm. On the 24th partial convulsions occurred, followed by coma and death.

"The cerebral veins and sinuses were generally congested, except in the anterior portion of the brain, where the appearance was normal. Between the brain and its meningeous covering, chiefly at the vertex and the base, was an effusion of clear serum. The whole amount of this fluid was estimated at two ounces. On slicing the brain, the puncta were numerous and large, both in the gray and white portions. With the exception of the congestion, the substance of the brain presented the normal appearance. No inflammatory lesions were present. We were not permitted to examine the condition of the intestines."

DIAGNOSIS.—The only disease with which spurious hydrocephalus is liable to be confounded is meningitis. The points of differential diagnosis are the history of the case, especially the antecedent diarrhoea or other exhausting ailment, evidence of prostration when the cerebral affection commenced, the depression of the anterior fontanelle in young children, and the cool face and extremities.

PROGNOSIS.—If the pathological state of the brain is simple exhaustion, the disease can often be arrested by judicious treatment. If an incorrect diagnosis be made, and the treatment employed is that appropriate for meningitis, the disease which it simulates, death is almost inevitable. If serous effusion has

occurred, unless slight, the result is apt to be unfavorable whatever may be the treatment. The disease in childhood is more easily managed than in infancy, but is less frequent. The prognosis is better in the cool months than during the heat of summer. It is more favorable if the child is over, than if under the age of one year. The occurrence of an irregular and intermittent pulse, of respiration accompanied by sighs, of inequality in the pupils, or their sluggish movements with increasing stupor, indicates an unfavorable issue. The cure of the primary disease, with the pulse and respiration still natural, or accelerated, without change of rhythm, pupils sensitive to light, drowsiness from which the patient is easily aroused to a state of entire consciousness, render recovery probable, with proper medication and alimentation.

TREATMENT.—The indications of treatment are twofold: first, to remove the primary pathological state which is the cause of the cerebral affection; and, secondly, to cure that affection. The first is important, since the successful treatment of all diseases requires the removal of the cause. The measures employed for this purpose are pointed out in our description of the diarrhoeal and other maladies which produce spurious hydrocephalus.

We may here say that as this disease is due in a very large proportion of cases to the exhausting effect of long-continued looseness of the bowels, astringents and alkalies are required in a majority of cases in the stage of irritability and sometimes also opiates.

Active sustaining measures are indicated. Exhausted nervous power as well as passive cerebral congestion requires this. The diet should be highly nutritious, comprising such substances as milk and animal broths, and should be given frequently. Brandy is required at short intervals. Dr. Good was in the habit of giving the aromatic spirits of ammonia, properly diluted, as a quick and active stimulant. Six or eight drops may be given in sweetened water to a child one year old, and repeated every two hours in cases of great urgency. If by a removal of the cause, and by the use of stimulants and nutritious food the patient is not relieved, there is probably more or less serous effusion. In some cases it is proper to produce moderate vesication behind the ears.

CHAPTER XI.

ECLAMPSIA.

THE term *eclampsia* is used in a more restricted sense by some writers than by others. It is used in the following pages to designate those convulsive seizures, clonic in their character, sometimes general, sometimes partial, which affect the external muscles. *Eclampsia* is therefore synonymous with clonic convulsions. It consists in a rapid, forcible, and involuntary muscular contraction, alternating with relaxation. It is distinguished from *clonus* in the fact that the latter is a more permanent state, and is characterized by muscular movements which are partially under the control of the will, and are not so violent.

Eclampsia occurs in a great variety of diseases, some of which are located in the cerebro-spinal system, some in other parts of the body, and some are constitutional. It may also be produced by temporary derangements of system, not sufficiently severe to be considered diseases, and by powerful mental impressions, those of an emotional nature affecting the delicate and sensitive nervous system of the child. Pathologists have recognized three distinct forms of *eclampsia*. The term *essential* or *idiopathic* is used when the convulsions have no appreciable anatomical character, that is, when there is no apparent pathological state in the brain or elsewhere, which gives rise to the attack. For example, if a child dies in convulsions from fright, and all the organs including the brain are found in their normal state, the *eclampsia* is called *idiopathic* or *essential*. If the cause is disease of the brain or spinal cord, it is termed *symptomatic*. If it arises from disease elsewhere, as from pneumonia, the term *sympathetic* is employed. This is in the main a good division, but *eclampsia* may be at the same time *sympathetic* and *symptomatic*, as when it occurs in consequence of congestion of brain, which is induced by severe and frequent paroxysms of whooping-cough.

CARIES.—*Eclampsia* occurs at any period of infancy and childhood, but is much more rare after the period of six or seven years

than previously. Some children are more liable to it than others. It is produced in one by an agency, which in another has no appreciable effect. There are some, generally those of an impressionable nervous system, who are seized with convulsions whenever there is any slight derangement in the digestive or other organs. Eclampsia is frequent in certain families. Thus, Bouchut mentions a family of ten persons, all of whom had convulsions in their infancy. One of them married, and had ten children, all which, with one exception, had convulsions.

The exciting causes of eclampsia are too numerous to be mentioned in full. It is a symptom in nearly all cerebral diseases. It is produced in the nursing by changes in the milk with which it is nourished. These changes are usually due to violent emotions of the mother, as anger, fright, and grief, to the use of acoescent or indigestible food, and to derangement temporary or permanent in her health. Thus, in a case related to me, the catamenia so affected the milk that the child was seized with eclampsia at each monthly period. In childhood the most common cause of chronic convulsions is the presence of some irritant in the *primæ viæ*. All kinds of fruit, even the mildest, may produce the disease, especially when eaten unripe or taken in undue quantity. I have known an infant to be seized with convulsions from eating strawberries, which parents usually regard as harmless, and one of the most violent and protracted cases of eclampsia which I have witnessed, occurred in a child over the age of six years, from swallowing, in considerable quantity, the parenchymatous portion of an orange. Constipation, worms, dysentery, intussusception, and painful dentition are also causes which are located in the digestive apparatus. Inflammation in some part of the respiratory apparatus is a not infrequent cause. Thus eclampsia occurs occasionally in severe coryza in consequence, according to some, of the proximity of the inflamed membrane to the brain, and the consequent afflux of blood to this organ. It is a common complication also of pertussis and pneumonia. It occurs often at the commencement of two of the eruptive fevers, namely, smallpox and scarlet fever, and in the course of the latter disease.

Violent emotions of the child may also cause eclampsia. Bouchut relates the case of a girl, five years old, who was corrected before her companions, and was so affected by anger that

convulsions occurred. Residence in close and overheated apartments, or in streets where the air is loaded with offensive vapors, and is stifling, is a predisposing cause, so that there is a larger proportion of deaths from convulsions in the cities than in the country.

In young children, burns, even when not very severe, are apt to terminate suddenly in eclampsia, succeeded by coma and death. Urinary calculi, both renal and vesical, frequently produce the same result.

Such are the more common causes of eclampsia. It is seen that they are of two kinds, predisposing and exciting. An excitable or irritable state of the nervous system constitutes the chief predisposition to the disease. Plethora, or its opposite state, anemia, increases the liability to an attack.

PREMONITORY STAGE.—In the majority of cases there are prodromic symptoms, which the experienced and careful physician can detect, so as to forewarn friends. There is more or less drowsiness, and, when disturbed, fretfulness. The eyes often have a wild or unnatural appearance; occasionally they are fixed for a moment on an object, and yet apparently without noticing it. The sleep is disturbed; in some there is unusual heat of head, and, if old enough, complaint of headache. At times, especially if the primary disease is febrile or inflammatory, there is incoherence of thought or expression, or even actual delirium. In some children, when eclampsia is threatening, the thumbs are seen to be carried often across the palms. I have observed this, especially during the convulsive cough of pertussis. A very important prognostic symptom is a sudden starting, or twitching of the limbs. This shows that the nervous system is profoundly impressed, and but slight additional excitation is required to develop eclampsia. In many this sudden starting is observed several hours before the attack.

The prodromic symptoms are often disregarded by friends who do not understand their significance. Even physicians, in the haste of their visits in many instances, do not notice them. The symptoms which precede symptomatic and sympathetic eclampsia, are, moreover, blended with those of the primary affection, and hence another reason why they are apt to be overlooked. When the convulsions are about to commence, the child generally lies quiet; the eyes are open and fixed. If spoken to or shaken, he

takes no notice, and does not speak. The direction of the eyes is then changed; often they are turned up; sometimes there is strabismus. The face may be pale or flushed, and sometimes, especially in cerebral diseases, the features present patches or streaks of a flushed appearance, while around them the natural color is preserved. Immediately before the spasmodic movements the child occasionally utters a piercing scream, which is probably involuntary, though it seems like a supplication for help. The duration of the prodromic stage is very different in different cases. It may last from a few minutes to several hours, or even more than a day.

SYMPTOMS.—Eclampsia is general or partial. If *general*, the muscles of the face, eyes, eyelids, and of all the limbs, are in a state of rapid involuntary contraction, alternating with relaxation. The features lose their natural expression, and are distorted; the mouth is drawn out of shape, often to one side, by the violent muscular action; the teeth are pressed together by tonic contraction of the masseters, and may be violently struck together, so as to lacerate the tongue, if it protrude, or are ground upon each other. Unless the attack is of short duration, frothy saliva, perhaps tinged with blood from the injured tongue, collects between the lips. The eyelids are usually open, though sometimes, according to Billiet and Barthez, they are closed. In severe cases the eyes are turned up, so that the pupils are lost under the upper eyelids, or the muscles of the eyes are involved in the spasmodic movements, so that the eyeballs are forcibly drawn from side to side. Occasionally, strabismus occurs. While the features are thus distorted, the head is forcibly retracted, or is turned to one side; the forearms are alternately pronated and supinated; the thumbs and fingers are convulsively flexed, so that the thumbs lie across the palms, and are covered by the fingers; the great toe is adducted, the other toes flexed; and the toes, as well as legs, participate more or less in the spasmodic movements.

In general convulsions, consciousness is usually lost. The head is hot previously to, and during the attack—at least in the first part of it—and the face flushed. In exceptional cases, especially in sympathetic eclampsia, the head is cool and the face pale. The pulse is somewhat accelerated, as well as the respiration, and the latter is rendered irregular if the respiratory

muscles, especially those of the larynx, are involved, as they generally are. The sphincters are relaxed during the convulsive attack, so that in many cases the urine and stools are passed involuntarily.

PARTIAL eclampsia is more common than the general form, and it occurs in the muscles of the face, including those of the eye, of the face, and of one or both upper extremities, or of the face and the extremities on one side. The spasmodic movements may be even limited to the muscles of the eyes, and they often occur only in these muscles and those of the face. Rarely, if ever, does eclampsia affect the legs without affecting also the muscles of the arms and face. In partial convulsive attacks, sensation and consciousness are in some not entirely lost, but in others they are not manifested if present.

The duration of an attack of eclampsia varies somewhat in different cases from a few minutes to several hours. The average is not more than from five to fifteen minutes. It does not often continue longer than three or four hours in the severest cases. It is sometimes said to last a much longer time, even for days, but there are in these cases intermissions. Violent attacks are usually short.

When the convulsion ends favorably, the spasmodic movements become less and less strong, and finally cease. The child then takes a deep inspiration, after which it lies quiet, and the respiration remains regular or moderately accelerated. Some fully recover in a few minutes if the eclampsia has been light and the cause transient, and seem to experience no inconvenience except soreness of the muscles and fatigue. Others soon recover consciousness, and their temperature, respiration, and circulation become natural, but they remain dull for a time, their minds are bewildered, and they are perhaps unable to speak. In a few hours these untoward symptoms pass away. In essential, and in a large proportion of cases of sympathetic eclampsia, if properly treated, and if the cause is recognized and removed, there is no recurrence of the convulsion; with others it is different. In many cases, especially of symptomatic eclampsia and of sympathetic, in which the cause is grave and persistent, the convulsions return after a variable period of a few minutes or a few hours. Six or eight or more convulsions may occur within twenty-four hours. Rarely they occur several times daily for several con-

secutive days, but severe convulsions, repeated at short intervals for twenty-four or forty-eight hours, usually end in fatal congestion of the brain or serous effusion. I once attended an infant about six months old, who had from four to twelve convulsions daily for eleven days, caused probably by a vesical calculus, as there was dysuria, and, at times, bloody urine. Some days after the convulsions were controlled, while we were deferring exploration of the bladder, death occurred suddenly, and the autopsy was not permitted. This case will be detailed elsewhere. Bouchut has witnessed a case of whooping-cough in which there were daily convulsions for eighteen days.

In all severe attacks of eclampsia, the respiration and circulation are so embarrassed that congestion of various organs results. This passive congestion in the respiratory organs is indicated by moist rales in the larynx and bronchial tubes; occurring in the brain, it is indicated by profound stupor. It has already been stated that death may occur from the cerebral congestion, which continuing is apt to end in effusion of serum or extravasation of blood. In these cases the convulsive movements cease, but there is no return of consciousness. The child lies quiet as if in sleep, with pupils not readily acted upon by light, and often somewhat dilated; gradually the limbs grow cool and the pulse feeble, and fatal coma supervenes.

Death does not ordinarily occur from one attack. There are several at intervals, during which the stupor is gradually becoming more and more profound, till, finally, there is total loss of consciousness and sensation. This is the most frequent mode of death, namely, death from coma. Apnea may occur in the first attack, ending life abruptly and unexpectedly, but in other instances it does not result till after several seizures, when, at length, one more violent than the others interrupts the respiratory function and causes death.

Occasionally, when life is preserved, there is some permanent ill effect of eclampsia. Bouchut says: "The origin of certain permanent contractions which bring on deviation of the head or of other parts, retraction of the limbs, paralysis, etc., must be referred to the convulsions of the muscles. I have seen several children in whom torticollis had no other cause. The drooping of the upper eyelid, strabismus, irregularity of the mouth, several contractions of the limbs, often depend on this influence. These

accidents are consequences of essential as well as of symptomatic convulsions."

ANATOMICAL CHARACTERS.—The morbid anatomy pertaining to eclampsia, is twofold; first, the pathological states which precede and usually cause the convulsive movements; secondly, those which result from them. We have seen that in sympathetic eclampsia, the diseases which sustain a causative relation are very numerous; some are constitutional, others local, and the latter may have their seat in almost any part of the economy, distinct from the cerebro-spinal axis. In some cases of sympathetic eclampsia, the immediate cause is too active a circulation, a state of hyperæmia of the cerebral vessels.

It has already been stated that this hyperæmia may be observed in young infants in whom the anterior fontanelle is open. Such infants, seized with acute inflammation of the mucous surfaces or of the lungs, often present a full and rapid pulse and a convex and forcibly pulsating fontanelle before the eclampsia begins. In other cases of sympathetic eclampsia, the primary disease induces passive congestion of the brain, and this in time gives rise to convulsions. Eclampsia occurring during the paroxysms of whooping-cough, affords an example. In the zymotic diseases, as smallpox and scarlet fever, eclampsia is doubtless often produced by the action of the specific virus on the cerebro-spinal system in the same manner as in the adult; anemia is a not infrequent cause. Therefore, in a considerable proportion of cases of eclampsia due to diseases not located in the cerebro-spinal system, in other words, of sympathetic eclampsia, the primary disease induces a pathological state of the cerebral vessels or of the blood which circulates through them, which state immediately precedes and accompanies the convulsions.

In other cases of sympathetic eclampsia the convulsive movements are produced by the primary disease, acting directly on the nervous system, through the medium of the nerves, without causing any appreciable alteration in the state of cerebro-spinal axis. Thus Barriér relates three fatal cases of convulsions occurring in pneumonia, in none of which was there anything abnormal in the condition of the brain or its membranes.

The pathological state preceding SYMPTOMATIC eclampsia differs in different cases, since convulsions occur in almost every disease of the brain and its membranes. The immediate cause of

this form of eclampsia may be active or passive cerebral congestion, with or without effusion; it may be compression of the brain from various causes; it may be a deficiency as well as excess of the cerebro-spinal fluid.

In essential eclampsia the cause sometimes produces congestion of the brain prior to the convulsive seizure. In other cases, as when convulsions occur immediately from the effect of anger or fright, there is no appreciable change in the state of the nervous centres previously to the attack.

Again, eclampsia, especially when severe and protracted, and when occurring in successive attacks, may be the cause of certain lesions. It produces congestion of the brain and membranes, and perhaps of the spinal cord. Sometimes, if the congestion is great, there is also serous effusion from the distended capillaries, and the fibrin in the larger vessels, as the sinuses, may coagulate.

The congestion resulting from eclampsia may give rise to extravasation of blood and the formation of a clot. If this accident occur, there is often paralysis affecting more or less of one side, permanent or gradually disappearing.

It may be difficult to decide whether the cerebral congestion precedes the eclampsia or is its result; but in those cases in which it precedes and operates as a cause, it is no doubt increased during the convulsive period. The spasmodic muscular action, by rendering respiration irregular and imperfect, also leads to congestion of the lungs and sometimes of the abdominal organs.

DIAGNOSIS.—The only disease for which there is danger of mistaking eclampsia is epilepsy. M. Ornanum mentions the following means of distinguishing the two: "Eclampsia differs from epilepsy in the frequent occurrence of prodromic symptoms; the clonic form of the convulsions, the rare appearance of froth in the mouth, the absence of a hideous livid aspect of the countenance, the spasmodic and sobbing character of the respiration, frequency of the pulse, and a state of quiet without snoring, which succeeds an attack." In the young child, however, the above points of distinction are not reliable as a means of differential diagnosis. Some patients, who seem to have genuine attacks of eclampsia in infancy and childhood, prove to be epileptic in subsequent years. The usual period of eclampsia is prior to the age of eight years, and if convulsions occur after this age without apparent exciting

cause, or from trifling causes, the disease is probably epilepsy; if prior to the age of eight years, and especially of three or four, they are in the vast majority of cases the convulsions of eclampsia.

It is often difficult to ascertain the form of eclampsia whether essential, symptomatic, or sympathetic, in other words, to determine the cause, till after the convulsions cease. This is especially true when, as is frequently the case, the physician is not summoned till the convulsive movements begin, and it is necessary that he should act promptly with but little knowledge of the child's previous history. If there is an obvious antecedent disease, as whooping-cough or meningitis, the cause is apparent; but if the previous health has been good, or but slightly disturbed, it may be necessary to make more than one visit or examination in order to ascertain the seat and character of the cause. In the majority of cases of convulsions occurring suddenly in a state of previous good health, the cause is seated in the intestines, but sudden and unexpected attacks may be due to the commencement of some inflammatory affection, as pneumonia, or of a febrile disease, as smallpox. Unless the eclampsia is speedily fatal, the physician, if he examine carefully, will in most cases, soon be able to ascertain the nature of the cause, and diagnose the form of the eclampsia.

PROGNOSIS.—Symptomatic eclampsia is always serious. If convulsions occur in the course of a cerebral disease, it indicates the approach of death, but if at the commencement, some recover. The recurrence of it, whatever the cerebral disease, is an almost certain prognostic of death.

In idiopathic or essential convulsions, the prognosis depends on the severity of the attack, and on the age, strength, and previous condition of the child. If there are predisposing or co-operating causes, as a nervous or excitable temperament, or dentition, the prognosis is less favorable than when such causes are absent.

In sympathetic eclampsia the prognosis varies greatly, according to the nature of the primary disease, and often according to the stage of that disease. If convulsions occur at the commencement of an eruptive fever, they generally subside without untoward symptoms, and the fever pursues a favorable course. Eclampsia, after the appearance of the eruption, is premonitory of a fatal result. I have not yet known a patient with scarlet fever recover who had convulsions after the rash had covered the body,

and experienced physicians of this city tell me that their observations correspond with mine. Dr. J. F. Meigs, however, relates one favorable case. If the cause of the eclampsia is located in or upon the mucous surfaces, a majority recover with judicious treatment. In convulsions consequent on pneumonia or a burn, more die than recover.

The prognosis in eclampsia is more favorable if the paralysis of the eyes is retained, the pupils remain sensitive to light, and consciousness soon returns. A fatal termination may be predicted, if, after the convulsion, the child remains stupid, without any evidence of returning consciousness.

TREATMENT.—Fortunately, inasmuch as the physician is often required to treat eclampsia in ignorance of the cause, the same measures are required to a considerable extent in all cases, whether the form be essential, symptomatic, or sympathetic. As early as possible in the attack the feet should be placed in hot water, to which mustard is added, or if it can be procured with little delay, a general warm bath may be used in place. This has a soothing effect upon the nervous system and promotes muscular relaxation, while it also produces derivation of blood from the cerebro-spinal axis. It is, therefore, useful, especially in those cases in which active or passive congestion precedes the eclampsia; it is also useful as a preventive of passive congestion of the brain, lungs, and other organs and the serous effusion, which, as stated above, are results of eclampsia. It should be continued from six to fifteen or twenty minutes, according to the severity and duration of the attack; at the same time cold applications should be made to the head, until its temperature, which is usually increased, is reduced. The application of a cloth, frequently wrung out of cold water, is the most convenient and ready mode of employing this agent. Cold has a prompt effect in contracting the cerebral vessels, and, therefore, tends to avert one of the chief dangers of eclampsia, namely, the congestion and effusion.

As a large proportion of convulsive attacks originate in the condition of the bowels, either solely or in part, it is advisable, unless there is a previous diarrhoeal affection, to prescribe an aperient.

The common enemata of soap and water will usually produce a free and speedy evacuation, and will sometimes disclose the cause of the eclampsia in the expulsion of seeds, or other indige-

tible substances or sychia. A cathartic is also often required, especially if the enemata fail to produce sufficient evacuations. In those that are robust, and especially in those beyond the age of two or three years, calomel is an excellent purgative, is easily given, and is prompt in its action. If there are symptoms indicating intestinal inflammation, the milder purgatives, as castor oil, are preferable, as, also, in young or feeble children. If the recent ingesta of the patient consisted of fruit or of substances of an indigestible character, an emetic should be given at once; as a teaspoonful of the syrup of ipecacuanha, repeated if necessary in fifteen or twenty minutes, to a young child, or this syrup in combination with lime syrup, to those that are older and are robust. Aside from the ejection of the offending substance which it produces, an emetic has some effect in controlling the convulsive movements.

Convulsions sometimes arise apparently in consequence of the muscular relaxation caused by the emetic. By such measures, or even without these, the attack usually terminates in a short time; but if it continue, and there is considerable heat of head or other indication of active congestion of this organ, we may try compression of the carotids by the fingers as recommended by Trousseau. This distinguished observer believed that he succeeded in diminishing the afflux of blood to the brain, and thereby shortening eclampsia by this simple expedient. Brown-Séquard (Remarks before the United States Medical Association, 1866) has recently stated that this result is due, not so much to compression of the carotid, as to pressure on the cervical portion of the sympathetic nerve, which (pressure) causes contraction of the cerebral vessels.

With or without trial of Trousseau's method in cases of protracted eclampsia, one or two leeches may be applied to the temples if the child is robust, and there is increased heat of face or head. The abstraction of blood directly from the head diminishes greatly the danger of congestion and effusion, and it has been the means of shortening the attack and saving life. Antispasmodics have been used for a long period in cases of eclampsia, and they are recommended in our standard works. I have never observed any benefit from the use in clonic convulsions of either asafoetida or valerian; though I have occasionally ordered the use of such agents both by the mouth and by enema. Chloro-

form, whether inhaled or swallowed, does control the convulsive movements. In protracted or frequently recurring *éclampsie*, especially when it is due to a highly sensitive nervous temperament, and there is probably little or no cerebral congestion, this is one of the most reliable agents employed by inhalation, and it is not unsafe if cautiously used by the physician himself. It should be employed only in the convulsion, and withheld the moment the spasmodic movements cease. In symptomatic *éclampsie*, or in the other forms if there are indications of cerebral congestion, I would not recommend its use. Dr. A. P. Merrill (*Amer. Journ. of Med. Sci.*, Oct. 1865) gives chloroform by the mouth in the treatment of this disease, and in doses which most practitioners would hesitate to prescribe. He has given even a teaspoonful at a dose, to a child a few years old, with a satisfactory result.

The propriety of prescribing opium in any form of convulsive attacks in children is doubted by many on account of the drowsiness which it produces. There can be no doubt, however, of the propriety and the good effect of its use in certain cases of essential and of sympathetic *éclampsie*. I refer to those cases in which attacks of *éclampsie* occur with intervals, during which there is no stupor, and the patient preserves consciousness. Opium may occasionally be of service in other cases, but in such they are especially indicated. Thus, recently in my practice, an infant about six weeks old, in whom there was an hereditary predisposition to *éclampsie*, was taken with diarrhea, and soon after with convulsions. The attack was short, but after a brief interval it returned, and during the subsequent twelve hours there were about twenty convulsions. There was no unusual heat of head or prominence of the anterior fontanelle or other evidence of congestion. The green and unhealthy appearance of the stools showed that the cause was located in the intestines. After trial of various remedies, among which were anti-spasmodics, these convulsive seizures were soon relieved by the use of paregoric in doses of five drops, which also had a salutary effect on the cause of the *éclampsie*, and in a few days there was complete restoration to health.

In recent times the attention of the profession has been directed to the bromide of potassium as a remedy in convulsive disorders. It is ordinarily prescribed alone, in powder or solution. I can

speak highly of its use in obstinate cases, not only in children approaching the age of puberty, but in infants, especially when the cause is obscure or beyond our reach. It should not be used in the eclampsia, but employed in the interval as a preventive. It produces a decided impression on the nervous system so as to diminish the liability to spasmodic affections. The following is an interesting case in which this agent was employed with the effect of relieving entirely the convulsive seizures, although the cause continued: On the 29th of January, 1866, I was asked to see an infant six months old, who during the preceding week had had an average of eight convulsions daily; each convulsion lasted about eight or ten minutes, and was general; the child was nursing, and had no teeth, and no decided swelling of the gums. A careful examination could detect no cause, though the infant was fretful and seemingly in considerable pain. Some days subsequently it was observed to pass, with apparent pain, urine in less quantity than when in health, and occasionally tinged with blood. The cause of the eclampsia was therefore probably a vesical calculus. Various remedies were made use of till February 1st without any diminution in the severity or frequency of the attacks; when bromide of potassium was prescribed in half grain doses every six hours. From February 1st to 3d there were two convulsions daily. On the 3d the medicine was given every three hours, after which there was no farther eclampsia. The medicine was discontinued on the 7th. The infant nursed as usual, and its health seemed to be re-established, with the exception of those symptoms which indicated the presence of a calculus. Examination of the bladder for stone was deferred for a few days, when about two weeks subsequently to the last convulsion the infant died suddenly and unexpectedly. Though the result of this case was unfavorable, the controlling power of the bromide over the eclampsia was apparent.

Those children who are subject to eclampsia from trifling causes, and sometimes without apparent cause, while their general health is good, are more benefited by bromide of potassium than by any other medicine. I have recently employed it, with the most satisfactory result, in the treatment of two children between the ages of six and ten years, who had taken various medicines, with no apparent benefit, for convulsive attacks to which they had been subject, and which excited the gravest apprehensions

that they would become confirmed epileptics. In both, the attacks were much less frequent and severe as soon as this medicine was commenced. Though much benefited, it is still uncertain whether they will be entirely cured. Bromide of potassium may be given in doses of one grain to a child one year old, every three to six hours, and an additional half grain, or grain, for every subsequent year.

B.—Potass. bromid. gr. 55);

Sacch. alb. ℥ss;

Aq. acid. ℥℥.

Dose, one teaspoonful every three to six hours, to a child of one year.

The treatment of eclampsia obviously should vary in different cases, according to the cause. If it occur in an eruptive fever, as scarlatina, and the eruption has receded, active revulsive measures, as hot mustard baths, are required; if in dysentery, or other internal inflammation, sinapisms should be applied over the affected part; if the gums are swollen, and the eclampsia is not readily controlled by the ordinary measures, they should be scarified. In those dangerous cases, in which symptoms of cerebral congestion continue after the eclampsia ceases, additional treatment is required. The child remains drowsy, does not speak, or apparently suffer in any way, and the pupils are less readily than in health. If this condition remains after the lapse of a few hours, there is probably serous effusion. All attacks of eclampsia, unless the mildest, are followed by a period of drowsiness, but the persistence of it, with symptoms which indicate hyperæmia, and perhaps effusion within the cranium, calls for the employment of additional measures. Vesication should then be produced behind the ears, mild revulsives be applied to the extremities, the head kept cool, the bowels open, and, in certain cases, a diuretic like iodide of potassium may be advantageously employed. The utmost care should be enjoined in reference to the hygienic management of those who are subject to eclampsia. The diet should be nutritious, but bland, and all causes of excitement be studiously avoided.

CHAPTER XII.

TETANUS NASCENTIUM.

TETANUS NASCENTIUM, or, as it is sometimes called, tetanus neonatorum, or tetanus infantum, is one of the most interesting diseases of infancy. It stands first in point of time, in the long catalogue of fatal maladies. Its advent is sudden and unexpected: a life promising well—for these patients are usually robust—is destroyed in a few hours. Tetanus nascentium is more frequent in some localities and in some conditions of life than in others. In New York it is more common than tetanus at any other age, or, indeed, in all other ages, since, according to the mortuary statistics of this city, more die from tetanus in the first year of life than subsequently, and death from this disease, in the nursing infant, occurs, with very few exceptions, in the first two weeks of life.

Interesting and important as is tetanus nascentium, it must be confessed that our knowledge of it is much more limited and imperfect than it should be when we consider what great advancement has been made in pathological inquiries during the present century. Our information in reference to its causation, symptoms, and proper treatment, is not much superior to that of M. DuRoi, or Dr. Joseph Clarke, who lived in the latter part of the last century.

Did we better understand the pathology of diseases in the newborn, or could we more accurately ascertain the condition of organs at this age, doubtless we should occasionally consider those phenomena which we now designate as a disease *per se* under the title tetanus nascentium, as symptoms of some other affection. But as tetanic rigidity and spasms in the newborn occur so abruptly, masking all other symptoms, and ordinarily ending in death without our knowing certainly whether or not there is any antecedent disease, it seems eminently proper that we should recognize the state in which such muscular rigidity occurs with such a rapid result, as an independent affection. This explanation

is required from the fact, that I have added to the accompanying table one case from Billard, which this observer relates under the head of spinal meningitis.

I have felt more fully justified in accepting the records of this case, from the fact that others have recorded very similar cases as examples of tetanus nascentium. In Billard's case, an infant three days old was attacked with convulsions. "His limbs were rigid and violently bent; the muscles of the face were in a continual state of contraction." On the following day "the convulsions continued; . . . the body remained rigid, and the vertebral column, which the weight of the trunk will cause to bend with the greatest ease in a young infant, remained straight and immovable whenever the child was raised." At the autopsy, in addition to meningeal apoplexy, which is often present in those who die of tetanus nascentium, a thick pellicular exudation was found upon the spinal arachnoid. There is, therefore, a strict accordance of the symptoms and history of this case with those which other observers describe as tetanus nascentium.

FATAL CASES.

- Case 1. Male; taken when three days old; lived sixty hours. Ishatt, *Edin. Med. and Surg. Journ.*, April, 1819.
- " 2. Female; taken when three days old; lived forty hours. *Ibid.*
- " 3. Taken when five days old; lived fifty hours. *Ibid.*
- " 4. Taken when three days old; lived one day. *Ibid.*
- " 5. Male; taken when two days old; lived two days. Billard, *Treatise on Diseases of Children*, Stewart's trans., p. 417.
- " 6. Male; taken when three days old; lived two days. Bonberg.
- " 7. Male; taken when six days old; lived ninety-three hours. Dr. Indick, *Month. Journ. of Med. Sci.*, Aug. 1859.
- " 8. Female; taken at five days; lived four days. Caleb Woodworth, M. D., *Boston Med. and Surg. Journ.*, Dec. 13, 1831.
- " 9. Negro; taken at seven days; lived twenty-four hours. P. C. Galliard, M. D., *South Journ. of Med. and Pharm.*, Sept. 1846.
- " 10. Male; taken when seven days old; lived one day. Augustus Eberle, M. D., *Missouri Med. and Surg. Journ.*, 1847.
- " 11. Taken when seven days old. D. B. Nailer, *N. O. Med. Journ.*, Nov. 1846.
- " 12. Male; taken when three days old; lived one day. *N. O. Med. and Surg. Journ.*, May, 1851.
- " 13. Negro; taken when three days old; lived three days. Robert H. Chinn, M. D., *N. O. Med. and Surg. Journ.*
- " 14. Taken when two days old; died in four hours after the doctor's visit. *Ibid.*

- Case 15. Taken when seven days old; lived one day. C. H. Cleveland, *New Jersey Med. Rep.*, April, 1852.
- " 16. Negro; taken when seven days old; death final. Greenville Dowell, *Amer. Journ. of Med. Sci.*, Jan. 1853.
- " 17. Taken when twelve days old; lived one day. Thomas F. Beersell communicated to Dr. Sims, *Amer. Journ. of Med. Sci.*, 1844.
- " 18. Taken when about five days old; died at about the age of nine days. B. H. Jones. *Ibid.*
- " 19. Taken at or soon after birth; lived two days. Dr. Sims, *Amer. Journ. of Med. Sci.*, April, 1846.
- " 20. Taken at the age of six days; lived one day. *Ibid.*
- " 21. Taken when three days old; lived two days. *Ibid.*
- " 22. Male; taken at the age of eight days; died in three hours. Communicated to the writer.
- " 23. Taken at the age of twelve hours; lived two days. Communicated to the writer.
- " 24. Female; taken when seven days old; lived forty-two hours. The writer.
- " 25. Male; taken at the age of seven days; lived about forty-eight hours. *Ibid.*
- " 26. Female; taken at the age of eight days; lived three days. *Ibid.*
- " 27. Female; taken at the age of five days; lived three days. *Ibid.*
- " 28. Female; taken when four days old; lived two days. *Ibid.*
- " 29. Taken when six days old; died next day. *Ibid.*
- " 30. Taken when five days old; lived twenty-four hours. *Ibid.*
- " 31. Taken when eight days old; lived two days. *Ibid.*
- " 32. Male; taken when five days old; lived one day. *Ibid.*

PAYABLE CASES.

- Case 1. Negro; female; taken when three days old; recovered in a few days. Robert S. Bally, *Charleston Med. Journ. and Rev.*, Nov. 1848.
- " 2. Negro; taken at eleven days; recovered in fifteen days. W. B. Lindsay, *N. H. Med. Journ.*, Sept. 1846.
- " 3. Negro; taken when ten days old; recovered in thirty-one days. P. C. Galliard, *Charleston Med. Journ. and Rev.*, Nov. 1858.
- " 4. Male; taken at the age of eight days; recovered in twenty-eight days. *Ibid.*
- " 5. Negro; taken at seven days; recovered in fifteen days. Augustus Eberle, *Missouri Med. and Surg. Journ.*, 1847.
- " 6. Taken when eight days old; recovered in four weeks. Farlang, *Edin. Med. and Surg. Journ.*, Jan. 1839.
- " 7. Taken at the age of one week; recovered in two days. Dr. Sims, *Amer. Journ. of Med. Sci.*, April, 1846.
- " 8. Female; taken at the age of three days; recovered in five weeks. The writer.

PERIOD OF COMMENCEMENT.—Fischl, who saw cases of tetanus nascentium in the Stuttgart Hospital, states (*Höcker's Annalen*, vol. iii. No. 3, p. 304) that it began in one case on the second day after birth, in eight on the fifth, and in seven on the seventh.

Professor Coderskjöld, of Stockholm, treated forty-two cases in hospital practice in 1834, and in these cases it usually commenced between the ages of four and six days. Copland says (*Medical Dictionary*) that it generally commences in the first seven or nine days after birth, and rarely later than the fourteenth. Romberg states that it commences between the fifth and ninth days. In two hundred cases observed by Reiske, in Stuttgart, in the course of forty-two years, it was never found to commence before the fifth, rarely after the ninth, and never after the eleventh day. Schneider says that the disease occurs oftenest between the second and seventh, and rarely after the ninth day. In six cases reported by Dr. C. Levy, of Copenhagen, it began in two on the third day, in two on the fifth, and in two on the sixth. Dr. Greenville Dowell (*Amer. Journ. of Med. Sci.* Jan. 1865), who has seen much of tetanus nascentium among the negroes in Mississippi and Texas, says it is almost sure to come on between the fifth and twelfth days after birth. In forty cases, the records of which I have collected, the disease began as follows:—

Age.	Cases.	Age.	Cases.
One day or under	2	Seven days	5
Two days	1	Eight "	6
Three "	9	Ten "	1
Four "	2	Eleven "	1
Five "	5	Twelve "	1
Six "	3		

Very rarely, as will be seen hereafter, tetanus nascentium begins at or so soon after birth that it may be properly called congenital.

FREQUENCY IN CERTAIN LOCALITIES.—Tetanus nascentium occurs probably in all countries, but it does not greatly increase the mortality except in certain localities. Some of the British and continental physicians, whose observations of disease have been extensive, confess to have seen so few cases that they have almost no personal knowledge of this affection. On the other hand, there are, or have been places in every zone where it is, or has been so prevalent as to sensibly check the increase of population. The attention of the profession, more than half a cen-

they since, was directed to the prevalence of tetanus nascentium in the Island of Heimsey, off the coast of Iceland. On this island scarcely an infant escaped, while on the mainland scarcely one was affected. Heimsey, the product of volcanic action of small extent and almost destitute of vegetation, supports a scanty population. The inhabitants live chiefly on the flesh and eggs of the sea fowl; and are filthy and degraded in their habits. About the year 1810, the Danish Government deputed the *landphysis* of Iceland to visit Heimsey, and ascertain the nature of the disease which was so destructive to the infants. Although this gentleman, from his brief stay, saw no case himself, he obtained interesting particulars in reference to the disease from the priests and parents. At this time scarcely an infant escaped. Again, according to Dr. Schleisner, whose report in reference to the same locality was published forty years later, this disease was still the most fatal of all infantile affections.

Tetanus nascentium is also represented as very fatal in the Island of St. Kilda, off the coast of Scotland. In the temperate regions of America and Europe cases are not frequent, except occasionally in the poor quarters of the cities, in foundling hospitals, and rarely in country towns where the conditions are favorable for its occurrence. The records of the Dublin, Stuttgart, and Stockholm Lying-in Asylums furnish many cases. In the town of Felda, Germany, in 1802, Dr. Schneider saw six cases in fourteen days, while a midwife in the same place stated that she had seen more than sixty in nine years.

But the greatest mortality from tetanus nascentium is in the warm climates, both of the Eastern and Western Hemispheres. In the West Indies, the southern portion of the United States, the equatorial regions of South America, and in the islands of Minorca and Bourbon, it has, in many localities, been the most frequent and fatal of infantile malaises.

It is an interesting fact that in the warm regions of the United States the victims are chiefly negro infants. L. S. Grier, M. D., of Mississippi, says, in the *N. O. Med. and Surg. Journal*, May, 1854: "The first form of disease which assails the negro among us is trismus. The mortality from this disease alone is very great. No statistical record, we suppose, has even been attempted, but from our individual experience we are almost willing to affirm that it decimates the African race upon our plantations within

the first week of independent existence. We have known more than one instance in which, of the births for one year, one-half became the victims of this disease, and that, too, in spite of the utmost watchfulness and care on the part of both planter and physician. Other places are more fortunate, but all suffer more or less; and the planter who escapes a year without having to record a case of trismus nascentium may congratulate himself on being more favored than his neighbors, and prepare himself for his own allotment, which is surely and speedily to arrive." Dr. Wooten (*N. O. Med. and Surg. Jour.*, May, 1846) says: "It is a disease of fatal frequency on the cotton plantations in this section of Alabama." He has, however, never seen a white child affected with it.

In New Orleans, according to the death statistics in our possession, which, however, relate to only one year, tetanus nascentium is the most fatal of all diseases except typhoid. Mr. Maxwell says, in the *Jamaican Physical Journal* (copied in the *London Lancet*, April 11th, 1855): "From observations that I have made for a series of years, . . . I found that the depopulating influence of trismus nascentium was not less than twenty-five per cent. It scarcely has a parallel within the bills of mortality." This gentleman's observations relate to the West Indies. Similar statements are made in reference to this disease as it occurs in Cayenne and Demerara, in South America.

While tetanus nascentium prevails in regions wide apart, and presenting very diverse climatic conditions, there is a similarity as regards the personal and domiciliary habits of the people who suffer most from its occurrence. It occurs chiefly among those who are filthy and degraded in their habits, who live either from choice or necessity in neglect of sanitary requirements. This fact aids us in an understanding of the

Cause.—That uncleanness and impure air are a cause of tetanus nascentium is as fully demonstrated as most facts in the etiology of disease. The attention of the profession was forcibly directed to this cause by Dr. Joseph Clarke, in a paper read before the Royal Irish Academy in 1789. This physician was in charge of the Dublin Lying-in Asylum, and had rightly concluded that the mortality among the new-born infants was due to imperfect ventilation. Through his advice apertures, twenty-four inches by six, were made in the ceiling of each ward; three holes an inch

in diameter, were bored in each window frame; the upper part of the doors leading into the gallery were also perforated with sixteen one-inch apertures, and the number of beds was reduced. The result of these simple sanitary regulations may be seen from Dr. Clarke's own statement. He says: "At the conclusion of the year 1782, of 17,650 infants born alive in the Lying-in Hospital of this city, 2944 had died within the first fortnight, that is, nearly every sixth child." The disease in nineteen cases out of twenty was tetanus asarcentium. After the wards were better ventilated, namely, from 1782 till the time of the preparation of Dr. Clarke's paper, 8963 children were born in the hospital, and only 419 in all had died, or about one in nineteen. So impressed was Dr. Erory Kennedy, who at a later period had charge of the same asylum, with the belief that Dr. Clarke had discovered the true cause, and had been able in a great measure to prevent it, that he writes in his enthusiastic way: "If we except Dr. Jenner, I know of no physician who has so far benefited his species, making the actual calculation of human life saved the criterion of his improvements." The cases occurring in my own practice were all not in tenement houses or shanties, where habits of cleanliness are impossible, and I have not yet seen, in the practice of others, nor heard of a case occurring in the better class of dwellings. The statements of physicians in the southern States, who speak from extensive observation among the negroes, are strongly corroborative of the idea that the disease is in great measure due to uncleanness and impure air.

Dr. Greenville Dowell, residing in Brazoria County, Texas, states that he has sometimes been able to trace the disease to the old bedclothes, saturated with excrementitious matters which are found in the negro caléas. In a paper published in the *Norfolk Journal of Med. and Surg.*, June, 1851, by Prof. John M. Watson, the frequency of this disease among the negroes is accounted for as follows:—

"When called to see their children, we find their clothes wet around their hips, and often up to their armpits with urine. . . . The child is thus presented to us, when, on examination, we find the unilical dressings not only wet with urine, but soiled, likewise, with feces, freely giving off an offensive urinous and fecal odor, combined at times with a gangrenous fetor arising from the decomposition, not desiccation, of the cord."

Another cause is believed to be some irritation in the bowels, as from retained meconium. Observers in the southern States and elsewhere occasionally mention this as a cause. In one case treated by myself, there was extreme constipation immediately before the attack, and, in another, diarrhoea preceded, and was the only apparent cause.

In other cases, the only assignable cause is exposure to wet or cold, or changes in temperature. Prof. Oelerschjold attributed the epölemic which he observed in Stockholm to a sudden change of temperature, from hot weather in May, to frosty in June. In a case related by Dr. P. C. Gaillard, in the *Southern Journal of Med. and Pharmacy*, Sept. 1846, the disease commenced as follows: The nurse came in with wet apron and clothes, in the evening; a short time after she had taken the child into her lap, it sneezed violently two or three times. At 10 P. M. tetanus began. The disease, in certain localities on the continent, is said to be more frequent where there is no parish church, in consequence of exposure in carrying infants to be christened. The influence of the weather in the production of tetanus neonatorum, is also shown by facts observed in the Stuttgart Hospital. In an aggregate of twenty-five cases treated in that institution, all but three occurred in the cold months. In the island of Cayenne, at a hamlet surrounded by mountains and dense forests, tetanus attacked only one in every twelve or fifteen of the infants. After a great part of the forests had been cut down, so as to allow access to the cold sea winds, almost all the new-born infants fell victims to tetanus. (*Jour. Cayenne*.)

Hein relates that a citizen of Berlin lost, successively, two children with tetanus neonatorum. When the second child fell ill, he observed that its cradle was exposed to a current of air. At the third accouchement the position of the cradle was changed, and the infant escaped. Exposure to wet and cold has been long recognised as a cause of the disease. According to Sauvages, "*Hic morbus hieme et cum anni lambdâ sepius advenit quam sicca æstate.*" (*Nosol. Method.* vol. i. p. 531.)

The causes of tetanus neonatorum, enumerated above, may be proximate or remote, may produce the disease by their direct effect on the system or by producing a pathological state, which in turn leads to the development of the disease. There are other causes which are always direct or immediate, namely, organic

alterations. In the bodies of those who die of this disease lesions are observed which doubtless result from the spasm. Again, other lesions are found, which, from their nature, could not be a result, and which, being observed in different cases, are to be regarded as direct causes. The most frequent of such lesions is inflammation of the umbilicus or umbilical vessels.

Moschion, who lived in the first century of the Christian era, stated in writings still extant that stagnant blood in the umbilical vessels sometimes produced dangerous disease in the new-born infant, and it is supposed that he referred to cases of tetanus nascentium. In modern times the attention of the profession was more particularly directed to this cause by a paper published by Dr. Colles, in the first volume of the *Dublin Hospital Reports*, in 1818. The observations published in this paper were made in the Dublin Lying-in Hospital during the period of five years. In each of these years he had witnessed from three to five post-mortem examinations in cases of infantile tetanus, and the lesions, he states, were in all much alike as follows: The floor of the umbilical fossa was lined by a membrane apparently formed by suppurative inflammation, and in the centre of this fossa was a large papilla. This papilla consisted of a soft yellow substance apparently the product of inflammation, and in all the cases the umbilical vessels were in contact with this substance and were pervious. In a few instances superficial ulcerations were found near the mouth of the umbilical vein, and occasionally the skin surrounding the umbilicus was raised. The peritoneum covering the vein was highly vascular, often not to a greater distance than an inch above the umbilicus, but sometimes as far as the fœdus of the liver. The peritoneum in the course of the umbilical arteries presented the inflammatory appearance in still greater degree sometimes as far as the sides of the bladder. The cellular substance lying along the arteries and urachus anteriorly was loaded with a yellow watery fluid. The inner surface of the umbilical vein was not inflamed, but its coats, in general, were thickened. On splitting open the arteries a thick yellow fluid, resembling coagulable lymph was found within their coats, and in all cases these vessels were thickened and hardened as far as the fundus of the bladder.

Dr. Finckh, who observed twenty-five cases in the Stuttgart Hospital, believes that the most frequent cause was suppurative

or ulceration of the umbilical cord. In ten of the twenty-five cases the navel was dry and cicatrized; in the remainder, it was either wet or swollen, with a bluish-red inflamed edge at the margin of the navel; a dirty viscid pus covered the umbilical depression.

Dr. Levy, physician of the Foundling Hospital in Copenhagen, attended twenty-two cases in that institution in 1838 and '39. Of these twenty died, and fifteen were examined carefully after death. In fourteen there were decided marks of inflammation in the umbilical arteries, especially those portions lying along the urinary bladder; in several cases the peritoneum over the arteries was much injected, and in three adherent either to the omentum or intestine by coagulable lymph; the coats of the arteries were thickened, their cavities dilated and containing dark reddish-brown or greenish puriform matter, always fetid. Sometimes the arterial tunica interna was found ulcerated and absent in places, and there was spongy thickening of the subjacent cellular tissue. In two cases the ulcerative process had extended from the tunica interna to the peritoneum, and there was a deposit of thick ichorous matter around the ulcer; in one case both arteries were so softened that their coats were scarcely distinguishable, and in another these vessels had become gangrenous. The appearance of the umbilicus was unchanged in four cases; in ten the fundus was red and filled with puriform fluid, which quickly reappeared when removed, and, in general, shortly before death the navel presented a greenish color.

According to Romberg, Dr. Schöller made post-mortem examinations in eighteen cases of tetanus neonatorum, and in fifteen found inflammation of the umbilical arteries. These vessels were swollen near the bladder, in one case to the diameter of four lines, and were found to contain pus. The lining membrane was eroded, or covered with an albuminous exudation. Both arteries were not always equally inflamed, and, in three cases, only one was affected.

Solmesman found minute points of suppuration in the umbilical vein in eight cases (*Hilcher's Auscult.*, vol. v. p. 484, 1840), and pus throughout the course of this vessel in one.

The observations mentioned above were made, for the most part, in hospitals on the Continent; but similar observations have been made in private practice. M. Boiran, of the Isle of Beau-

hon, says that he has found in every case inflammation around the umbilicus (*Gazette Médicale*, Paris, July 11, 1861). Dr. John Partridge (*Edin. Med. and Surg. Journ.*, Jan. 1830), who resided at St. John's, Antigua, attributes the disease to improper dressing of the umbilicus. The same opinion is expressed by Mr. Maxwell, who also saw the disease in the West Indies (*Jamaica Phys. Journ.*, copied into the *London Lancet*, April 11, 1855). Dr. Ransom states, in a communication to Prof. John M. Watson (*Nashville Journ. of Med. and Surg.*, June, 1851) that he has never seen a case of tetanus nascentium, in which the umbilicus was healthy. In a case related by Robert S. Raily, in the *Charleston Med. Journ. and Rev.*, Nov. 1848, there was a hard scab on one side of the umbilicus; and this part was much distended. A discharge followed the removal of the scab, and the child recovered. In a favorable case, related by W. B. Lindsay, in the *N. O. Med. and Surg. Journ.*, Sept. 1846, the umbilicus was turned, and not disposed to heal. Dr. H. O. Wooten (same Journal, May, 1846) attributes the disease to the condition of the umbilicus and umbilical vessels, and states that he has found the umbilicus gangrenous. In a case related in the *N. O. Med. and Surg. Journ.*, May 1, 1853, the umbilical vessels were blocked up by purulent matter. Robert A. Chinn, M. D., Brazoria, Texas (*N. O. Med. and Surg. Journ.*, Sept. 1854) believes one cause of the disease to be improper tying and management of the umbilical cord, by which a diseased state is produced, which extends to the umbilicus, and thence to the viscera. At a meeting of the Obstetrical Society of Edinburgh, held April 24, 1850, Dr. Imbach related a case in which there was a dark and gangrenous appearance of the integument around the umbilicus, and the peritonæum underneath was also dark, but not inflamed; umbilical vein healthy; a little fibrin in the left umbilical artery; right umbilical artery much diseased; its two inner coats apparently destroyed, and in their place a yellow pulsatious slough, in which pus globules were discovered with the microscope.

It is evident that the pathological state of the umbilicus and umbilical vessels described above, and which has been noticed by so many observers in different countries, cannot result from the tetanus. It is possible that the puriform substance noticed in the umbilical vessels was disintegrated fibrin, which had coagulated at the time of ligation of the cord, and the cells seen

by Dr. Imbach, which were believed by him to be pus, were white corpuscles of the blood (see *Virekows Cellular Pathology*). Still, the evidences of inflammation, in at least a part of the cases, were of a positive character.

The belief that these lesions preceded and produced the tetanus comports with the well-known traumatic causation of tetanus in the adult. This belief is strengthened by the fact, which will appear further on in our remarks, that tetanus neonatorum, from being frequent in certain localities, has become infrequent through greater care in dressing and managing the umbilical cord.

But there are cases of tetanus neonatorum in which there is no disease in or about the umbilicus. Dr. Finckh, of Stuttgart, examined the umbilical vessels in eleven cases without discovering any pathological change. Dr. Samuel B. Lalet, master of the Dublin Lying-in Hospital, published in the *Edin. Med. and Surg. Journ.*, April, 1819, a paper entitled "An Inquiry into an Alleged Connection between Trismus Neonatorum and Certain Diseased Appearances in the Umbilicus." This paper was designed as a reply to the essay of Dr. Colles. Dr. Lalet relates several cases in which there was no disease of the umbilicus and umbilical vessels, and others in which the disease was so slight that it probably produced no injurious effect on the health of the child. Dr. James Thompson, who spent considerable time in the tropical regions, says (*Edin. Med. and Surg. Journ.*, Jan. 1822): "I have myself examined nearly forty cases of infants that have sunk under this complaint. In many I have looked at no other part but the navel, and have found it in all states; sometimes perfectly healed, especially if the infants had lived several days; at other times, a simple clean wound. When death occurred on the fifth or sixth day, the wound was frequently in a raw state. I never yet saw it in a sphacelated condition." This writer concludes from his observations that there are cases in which the cause is located elsewhere than in the umbilicus or umbilical vessels. In the *Dub. Journ. of Med. and Chir. Sci.*, Jan. 1834, Dr. John Brown remarks: "From dissections . . . we have never been able to discover any peculiar morbid appearance which would justify us in offering any explanation of the pathology of the disease." In my own cases there was no evidence of disease of the umbilicus or umbilical vessels so far as could be ascertained by external

examination, and in one (No. 32) a careful post-mortem examination disclosed no lesion of these parts.

The inference from the above observations is that, although umbilical disease may be an occasional, probably not infrequent cause of tetanus nascentium, cases occur in which such disease is not present, and we must look for the cause elsewhere. From the nature of tetanus nascentium the cerebro-spinal axis has been from time to time examined in those who have died of this disease, and occasionally sufficient cause has been found in this part of the system.

I have alluded in another connection to a case from Billand, in which tetanic rigidity occurred in an infant three days old, as the result of spinal meningitis. That tonic spasms not infrequently occur in older children in consequence of meningeal inflammation is well known, and in some of the reported epidemics of tetanus nascentium, meningitis was really present, and was doubtless the cause of the tonic spasms. Such an epidemic was observed by Professor Cedersehjöld in Stockholm, in 1834. Within a few months he treated forty-two cases, and in addition to the lesions which are known to result from tetanus, there was found in the bodies examined a plastic exudation at the base of the brain. Finckh, of Stuttgart, made twenty post-mortem examinations of those who had died of this disease, and in nine found spinal meningeal inflammation.

Meningitis in the new-born infant is, however, rare, and we must regard it as an exceptional cause of tetanus.

In 1846 there appeared from the pen of Dr. Sims, then practising at Montgomery, Alabama, a paper designed to show that tetanus nascentium is produced by pressure exerted on the nervous centre, through depression of the occipital bone. In 1848 the same writer published a second paper, also in the *Amer. Journ. of Med. Sci.*, fully announcing his theory as follows: "That trismus nascentium is a disease of centric origin depending on a mechanical pressure exerted on the medulla oblongata and its nerves; that this pressure is the result, most generally of an inward displacement of the occipital bone, often very perceptible, but sometimes so slight as to be detected with difficulty; that this displaced condition of the occiput is one of the fixed physiological laws of the parturient state; that when it persists for any length of time after birth it becomes a pathological condition,

capable of producing all the symptoms characterizing trismus nascentium, which are instantly relieved simply by rectifying this abnormal displacement, and thereby removing pressure from the base of the brain." In both papers cases are narrated in support of this theory, but there are serious objections to this mode of explaining the occurrence of the disease. In the first place, if this explanation were correct, tetanus ought ordinarily to occur sooner, for the occiput is as much depressed previously, and in the majority of cases more depressed than at the period when it does actually commence. Pressure on the medulla would certainly be followed by immediate and marked symptoms instead of an immunity for four or five days.

Again, well-known facts in reference to the causation of tetanus nascentium conflict with Dr. Sims's theory, as epidemics of the disease, its prevalence in one locality and absence in another, although no particular attention is given to the position of the infant, the diminution of the number of cases by greater attention to cleanliness, of which there is abundant proof. Besides, there are many cases of tetanus nascentium, at the commencement of which there is no perceptible displacement of the occipital bone, and no scientific inquirer should assume to exist what is not apparent, in order to support a theory.

A careful examination of the cases of Dr. Sims must convince any one who has seen much of the disease, that there is no certainty that several of them were genuine, and there is a strong probability that some were not. Besides, other physicians have not derived that benefit from placing the infant on the side, which would be likely to result were the theory of Dr. Sims correct.

After the publication of Dr. Sims's papers, the attention of physicians in the Southern States, who saw much of infantile tetanus among the slaves, was directed to an examination of the correctness of his views, and though a few wrote approvingly of them, in the belief that his explanation held good in some cases, they were rejected by the majority. Drs. P. O. Gaillard (*Charleston Med. Journ. and Rev.*, Nov. 1853), Wakely (*N. O. Med. and Surg. Journ.*, 1849) and Grafton (*N. O. Med. and Surg. Journ.*, July, 1853) relate cases in which there was no evidence of occipital displacement. In my own cases, depression of the occipital bone was sometimes noticed, occasionally to a considerable extent, but

in no instance did this depression seem to be a cause but a result, and it became more and more marked as the disease advanced.

The correct explanation of the inequality of the cranial bones, sometimes observed in tetanus nascentium, is probably as follows: If the new-born infant becomes emaciated, the volume of the brain is diminished, like that of the trunk or limbs, and the sinking of the occipital bone simply corresponds with the amount of waste in the cerebral substance. Whatever the disease in the young infant, if there is much emaciation, the parietal bones will usually be found more prominent than the occipital. Now, in fatal tetanus nascentium, emaciation is very rapid; those fleshy and plump, if the disease do not speedily end, become pinched and wrinkled. Viewed in this light, the occipital depression, so far as it has any effect, must be regarded as conservative. It prevents serous effusion, which, in a similar state of waste, occurs in older children whose cranial bones are consolidated.

Hence, the theory of Dr. Sims cannot be accepted; and yet there are a few cases on record in which tetanus seemed to be due to injury received at birth. Dr. Sims has related one such case, that of a negro infant. The mistress, an observing lady, gave to Dr. Sims the following account of it: Its head was "mightily nashed. . . . The bones seemed to be loose. I got it to take a little boiled milk on the first day; but it swallowed very little and very badly, for its jaws seemed to be locked. On the next day it took spasms and got stiff all over; its hands were shut up tight, and its arms were bent up so (she placed her forearms at right angles). Every time I touched it the spasms would get worse all over, screwing up its face till it was the ugliest thing in the world; and when the spasms wore off it looked as well as any other new-born baby. But then the stiffness never left it, and the spasms kept coming and going till it died." It lived two days.

It is evident from the description of the mistress, that this was a case of tetanus nascentium, commencing at, or so soon after birth, that it was really congenital. The apparent cause was injury of the head, occurring in consequence of protracted birth; the infant was resuscitated with difficulty after several minutes.

Dr. W. C. Sutton published a similar case in the *Newcastle Journal of Med. and Surg.*, April, 1853. The infant at birth was apparently dead, but was resuscitated so as to live eighteen hours in a state of tetanic rigidity. In these cases of congenital tetanus,

doubtless, the cerebro-spinal axis is in some way affected; but in the absence of post-mortem examinations, the exact nature of the injury is uncertain.

It is evident, therefore, that in this disease, as in eclampsia, the cause in different cases may be entirely distinct. Dr. James Johnson, many years ago, expressed his belief in the multiplicity of causes, and he had been a careful and intelligent observer in the West Indies.

The causes may be arranged in two groups, one external, the other internal. In the first group may be placed imperfect ventilation, personal and domestic uncleanliness, and atmospheric vicissitudes; in the second group, so far as ascertained, inflammation of the umbilical and umbilical vessels, meningitis, and, rarely, injury of the cerebro-spinal axis during birth.

The lesions resulting from tetanus *nascens* pertain chiefly to the circulatory system. In the cases examined by Prof. Cedersehjold, of Stockholm, already alluded to, the meningeal and cerebral vessels, and those of the spinal cord, the cavities of the heart, and the large vessels connected with the heart, were distended with blood.

Finckh made post-mortem inspection of twenty cases in the Stuttgart Hospital, the bodies, at death, having been placed on their faces, in order to prevent any deceptive appearance from the gravitation of blood. In four there was no appreciable alteration in the spinal cord or its membranes. In the remaining sixteen there was effusion of blood, in considerable quantity, the whole length of the spinal cord, between the bony walls and the dura mater. It should be stated, however, that there was spinal meningeal inflammation in nine of the sixteen, though the extravasation did not, probably, result from the inflammation, but from the tetanus. The blood, in Finckh's cases, was very dark, sometimes fluid, at other times coagulated. In one case there was no change in the appearance of the brain or its membranes. In the remaining nineteen, more or less extravasated blood was found on the surface of the brain, or in its interior. The substance of the brain was healthy, as also its membranes, except the congestion. The only abnormal appearance observed in the thoracic and abdominal viscera was strong contraction of some portion of the intestinal tube in five cases. Dr. West says: "The most frequent post-mortem appearance in these cases"—referring

to tetanus nascentium—"and that which I found in the bodies of all the four children whom I observed, consists of effusion of blood, either fluid or coagulated, into the cellular tissue surrounding the sheath of the cord. Conjoined with this there is generally a congested state of the vessels of the spinal arachnoid, and sometimes an effusion of blood or serum into its cavity. The signs of congestion about the head are less constant, though much oftener present than absent, and sometimes existing in an extreme degree; while in one instance I found not merely a highly congested state of the cerebral vessels, but also an effusion of blood, in considerable quantity, between the skull and dura mater, and also a slighter effusion into the arachnoid cavity." Dr. Weber, of Kiel, also placed infants who had died of tetanus, on their faces, and, without exception, found injection of the capillaries of the cord and spinal meninges, and extravasation of blood. M. Matuszynski, according to Bouchut, "has observed effusions of blood, of variable quantity, in the cerebral pia mater, in the ventricles, and in the choroid plexuses, with considerable injection of the membranes of the brain. He has also seen serous infiltration beneath the arachnoid, and serous effusion into the ventricles, accompanied by a diminution of the consistence of the cerebral substance." In two cases examined by myself, there was intense injection of the cerebral meninges, and of the meninges of the upper part of the spine, but no extravasation was noticed. The spinal canal was not opened. In a third case, in which the spinal canal was opened, there was extravasation in addition to the congestion; this was especially observed along the spinal sheath.

Dr. H. O. Wooten (*N. O. Med. and Surg. Journ.*, May, 1846) states that he has made several post-mortem examinations, and has found the pathological appearances as uniform as in any other disease, as follows: "Engorgement of the substance of the brain, and of the meninges lining the base of the brain, the medulla oblongata, and spinal marrow; liver congested."

In a case related by Dr. Inlack before the Edin. Obst. Soc., April 24, 1850, the upper part of the lungs was healthy, the posterior portion congested, and containing many dark points; heart and liver healthy; small intestines of a light-brown color; stomach and large intestines pale; there had been umbilical hemorrhage.

Boulsberg states that he found in a child, who had died of

tetanus nascentium, such intense congestion of the veins and sinuses of the brain, that a slight touch, and the removal of the cranial bones, produced extravasation of the partly coagulated and partly fluid blood. Dr. Scholler, on the other hand, found actual extravasation of blood in the spinal canal in only *one* case in eighteen.

It is seen from the above observations, that tetanus nascentium is ordinarily accompanied by great passive congestion, which is especially marked in the cerebro-spinal axis, and that sometimes the distended capillaries are ruptured. The embarrassment of respiration and the retarded circulation of blood consequent on the tetanic rigidity afford sufficient explanation of this state of the vessels.

SYMPTOMS.—In many cases premonitory symptoms are absent, or are so slight as to escape notice. Sometimes there is a degree of fretfulness previously, but no more than is often observed in those who continue in good health. The first symptom which alarms the parents, and shows the grave nature of the commencing disease, is inability to nurse, or evident pain and hesitation in nursing. Commencing with rigidity of the masseters, the disease gradually extends to the other voluntary muscles, and in the course of a few hours the muscles of the limbs, as well as of the trunk, are involved. Persistent muscular contraction, which is the pathognomonic feature of tetanus nascentium, is developed not fully in the beginning, but by degrees in each affected muscle, so that it is not till after the lapse of several hours, perhaps even a day, that the greatest amount of rigidity is attained. Therefore, in the commencement of the disease, the limbs can be bent, and the jaws pressed open, more readily than at a subsequent stage, though with manifest pain to the infant.

During the period of maximum rigidity, the jaws are fixed almost immovably, often with a little interstice between them, against which the tongue presses, and in which and between the lips, froth collects. The head is thrown back and held in one position by the stiffness of the cervical muscles. The forearms are flexed; the thumbs are thrown across the palms of the hands, and are firmly clenched by the fingers; the thighs are drawn towards the trunk; the great toes are adducted, and the other toes flexed. Occasionally opisthotonus results from the extreme contraction of the dorsal and posterior cervical muscles. The infant

can sometimes be raised without any yielding of the muscles by one hand under the occiput and the other under the heels.

The rigidity is liable to variation in its intensity, even after the full development of the disease. If the infant is quiet, especially if asleep, the muscles are partially relaxed to such an extent, sometimes in the first stages of the complaint that the features have a placid and natural expression, though only for a short time. There are frequent exacerbations in the muscular contraction, sometimes occurring without any apparent cause, and sometimes produced by anything which excites or disturbs the child. Attempts to open the lips or jaws, or eyelids, or to bend the limbs, blowing on the face, or even the crawling of a fly upon it occasions the paroxysm.

During the paroxysm the eyelids are forcibly compressed, as well as the lips, which are either drawn in or are pouting; the forehead and cheeks are thrown into wrinkles, and the physiognomy is indicative of great suffering. The unnatural positions of the trunk and limbs, which result from the muscular contraction, are increased for the moment; the head is more forcibly thrown back, and the limbs more strongly flexed. The muscular movements which occur during the paroxysms are sometimes described as clonic spasms. There is indeed occasionally some quivering of the limbs, and yet, as I have on different occasions noticed, so far from their being clonic spasms, their tonic character continues, and is merely intensified. In fatal cases the paroxysms occur more and more frequently until the period of collapse.

The crying of the child in tetanus nascentium is never loud, however great the suffering. It is variously described by writers as "whispering" or "whining." It is of this suppressed character in consequence of the rigid state of the respiratory muscles and their imperfect movement.

During the exacerbation respiration is suspended or is imperfect, and the circulation so retarded that the surface becomes of a deep red, almost livid color. Sometimes epistaxis occurs as a partial relief to the congestion, and sometimes, though less frequently, the blood forces itself from the congested liver along the subileal vein, and escapes from the umbilicus. I have already alluded to the occurrence of meningeal apoplexy.

The frequency of the pulse and respiration varies in different cases, and at different stages of the same case. They are often

somewhat accelerated, but at other times are natural or are even slower than in health.

While the appetite of the infant, to appearance, is not diminished, the pain which it experiences in nursing is such that alimentation is necessarily deficient. It can be fed with a spoon for a time after it ceases to take food in the natural way, but artificial feeding soon fails. The milk placed in its mouth is in great part pressed back through the violence of the spasm, which is induced by the attempt to feed it.

In consequence of imperfect nutrition, the infant rapidly wastes away. There is no other disease except the diarrhoeal affections in which emaciation is so rapid. In a case related by Dr. W. B. Lindsay in the *N. O. Med. Journ.*, Sept. 1846, the record states that "the infant was fat three days before, but was now emaciated." Rosenberg, who saw tetanus masticatorius in European hospitals, and Dr. Robert H. Chinn, of Texas (*N. O. Med. and Surg. Journ.*, Sept. 1854), both speak of the rapid emaciation. The trunk and extremities lose their fulness, and the features become pinched. Several observers have noticed the appearance of miliaria in this reduced state of system, especially around the shoulders, and sometimes a decidedly lenticular lute appears on the skin.

The condition of the bowels is not uniform. They may be relaxed, particularly if the disease is due to some irritation in them; in other cases the stools are natural or constipated.

It is often difficult to ascertain the state of the eyes, since attempts to open the eyelids bring on spasms and cause firm compression of the lids against each other. According to Sir Henry Holland, one of the first symptoms which occurred in the cases on the island of Heimaey, was strabismus, with rolling of the eyes. But this statement must be received with caution, since these cases were not seen by any physician, and the information was obtained from the parents and priests. If true, the proximate cause of the disease in Heimaey would seem to be located in the cerebro-spinal axis. I have seen the pupils contracted in the stage of collapse.

MODE OF DEATH.—Death in tetanus masticatorius may occur from asphyxia in the paroxysms, from extreme congestion of the cerebral vessels, or apoplexy; and, lastly, it may occur from exhaustion. The last mode is, probably, the most frequent.

PROGNOSIS.—All writers agree that tetanus nascentium rarely terminates favorably. Cullen attributes the ignorance of physicians in reference to it, to the fact that it is so little amenable to treatment, that they are not usually summoned to attend those affected with it. In the island of Heimsay, of one hundred and eighty-five cases, occurring during a series of years about the commencement of the present century, not one survived; and in the same locality, at a more recent period, according to the report of Dr. Schleisner already alluded to, sixty-four per cent. died. Similar statements in regard to the mortality of tetanus nascentium are given by physicians in the Southern States. Dr. H. O. Wooten, of Alabama, says (*N. O. Med. Jour.*, May, 1846) that he has "never seen a decided case of tetanus nascentium that did not prove fatal; . . . and that it is very generally deemed useless to call in medical aid after the initiatory symptoms are well declared. Mr. Maxwell, speaking in reference to the West Indies, says (*Jamaica Phys. Jour.*, copied into the *Lancet*, April 11th, 1853): "From observations which I have made for a series of years, . . . I found that the depopulating influence of trismus nascentium was not less than twenty-five per cent. It scarcely has a parallel within the bills of mortality." Dr. D. B. Nailer (*N. O. Med. Jour.*, Nov. 1846) says: "About two-thirds of the deaths among the negro children are from this disease, and so uniformly fatal is it, that a physician is never sent for."

Yet death does not always result. Eight of the forty cases in my collection recovered; but a correct opinion cannot be formed from this of the actual ratio of favorable to unfavorable cases, since recovery is so remarkable that favorable cases are much more likely to be published. In the history of these eight cases, two interesting facts are noticed, which, when present, may serve as a ground for hope of a successful termination. These were, the age at which the disease began, and fluctuation in the symptoms. With two exceptions, the infants who recovered were about a week old when the initiatory symptoms appeared, and there were fluctuations in the gravity of the symptoms; whereas, fatal cases ordinarily grow progressively worse. Yet in favorable cases, the symptoms are never so severe as they become in a few hours in those who succumb.

DURATION IN FATAL CASES.—Of eighteen cases observed by Finckh in the Stuttgart Hospital, fifteen died in two days, two in

five days, and one in seven days. During the epidemic in the Stockholm hospitals, in 1854, where forty-two cases were treated, the disease seldom lasted more than two days. Romberg says: "It generally lasts from two to four days, but its duration is at times limited at from eight to twenty-four hours, and occasionally, though rarely, it extends from five to nine days."

In thirty-one fatal cases in my collection, in which the duration is mentioned—

One lived	2 hours.
Eleven others lived	1 day or less.
Twelve lived	2 days.
Four "	3 "
Three "	4 "

Both Underwood, who published a little treatise on diseases of children, in 1789, and Dr. Elsasser at a more recent date, record fatal cases which were unusually protracted. The one described by Underwood was treated in the British Lying-in Hospital, and, although all the others treated in this institution died by the third day, this lived six weeks; but it is suggested by the author, that death was due in part to some other affection. The child treated by Elsasser lived thirty-one days.

DURATION IN FAVORABLE CASES.—In the eight favorable cases in my collection, the duration of the disease, reckoned from the time when the infant ceased nursing till it began again, was as follows: In one case, two days; in one, a few days; in one, fourteen days; in two, fifteen days; in one, twenty-eight days; in one, twenty-one days; and in the remaining case, about five weeks.

DIAGNOSIS.—To one who has seen cases of tetanus infantium, or is familiar with its symptoms, diagnosis is easy. The symptoms which possess diagnostic value are more manifest and reliable than in most other infantile affections. Permanent rigidity of the voluntary muscles, with temporary exacerbations, such as have been described above, which are induced by any cause which disturbs the infant—as attempts to open the mouth or eyelids, is pathognomonic.

PREVENTIVE TREATMENT.—While tetanus infantium, if fully developed, is ordinarily fatal, in spite of any remedial measures heretofore used, there is no doubt of the efficacy and value of preventive measures, when properly employed. This was shown

by the great reduction in mortality in the Dublin Lying-in Hospital through the thorough ventilation introduced by Dr. Clarke. Dr. Meriwether, of Montgomery, Ala., says (*Amer. Journ. of Med. Sci.*, April, 1854): "When the disease appears endemically on a plantation, it may be arrested by having the negro houses white-washed with lime, inside and out; by raising the floors above the ground; by removing all filth from under and about the houses; by particular attention to cleanliness in the bedding and clothes of the mother; and in the dressing of the child, so as to prevent any of the matter from the umbilicus lying long in contact with the skin." Many physicians, especially in the Southern States, speak confidently of care in dressing the cord, and attention to the umbilicus, as a means of prevention. In the *N. O. Med. and Surg. Journ.*, July, 1853, Dr. Grafton says that he has "never known the disease to occur in any child whose navel had the turpentine dressing." He uses turpentine as follows: "At the first time, a few drops of the undiluted turpentine is applied immediately to the umbilicus around the cord, and it is anointed at every succeeding dressing, the turpentine being diluted one-half or two-thirds with olive oil, lard, or fresh butter." This use of turpentine has also been recommended by other practitioners in the warm regions.

Dr. John Furlonge, of St. John's, Antigua, believes (*Edin. Med. and Surg. Journ.*, Jan. 1830) that no case would occur with the following treatment: "The cord, when divided, should be wrapped in clean linen. Every night, for two weeks, one or two drops of tinct. opii and aqua viva, equal parts, should be given, and castor oil, with a little magnesia, every morning. The child must be washed in tepid water every morning, and the fæces dressed." If this treatment is attended by the success which is claimed for it by Dr. Furlonge, so great care in dressing the cord is certainly well repaid in localities, as at Antigua, where a large proportion of the infants die of tetanus.

Some experienced observers go so far as to assert that it is possible to ward off tetanus maseentium after the occurrence of premonitory symptoms. Dr. Dowell says (*Amer. Journ. of the Med. Sci.*, January, 1863): "Some with slight twitchings of the muscles, have recovered without any trouble by being put into a mustard bath, washed clean, and put in a clean and well-ventilated cabin."

TREATMENT.—In considering the effect of medicinal agents which have been employed in the treatment of tetanus neonatorum, the great difficulty which the child experiences in swallowing should be borne in mind. Without care a considerable part of the dose is lost by the spasm of the muscles of deglutition, which ordinarily occurs when the spoon is placed in the mouth, so that unless special attention is given to this matter, it is uncertain whether the prescribed dose is fully administered.

The treatment employed by different physicians has been very diverse. Antiphlogistic remedies were prescribed by Finckh, but every case so treated was fatal. He states that whenever blood was abstracted, even in small quantities, the symptoms were aggravated. The same result has followed depletory measures in the practice of other physicians.

The internal remedies which have been most frequently prescribed are opiates and antispasmodics. Furlonge, in a favorable case, gave laudanum, in doses of one drop every three hours, alternately with two grains of Dover's powder. Woodworth also gave one-drop doses of laudanum; Eberle one-sixth of a drop hourly. The opiate has generally been given in combination with an antispasmodic. The Dover's powder, given every three hours by Furlonge, was combined with five grains of sulphate of zinc. The hourly doses of laudanum, by Eberle, were combined with six drops of tincture of asafoetida.

When anesthetics began to be employed in the treatment of diseases it was believed that they would be especially useful in cases of tetanus. Accordingly chloroform has been used in tetanus neonatorum with the effect of controlling the spasms during the time of its use, but without curing the disease. In Case 7, in our first table, it was employed several times, but apparently without delaying the fatal result. The editor of the *New Orleans Medical and Surgical Journal* states, in the May issue of that periodical for 1853, that he has used chloroform in tetanus neonatorum with the effect, he believes, of prolonging life. Anesthetics certainly relieve the suffering of the infant, and on this account, even if they do not prolong life, their careful use seems proper.

The administration of alcoholic stimulants is required at short intervals on account of the rapid emaciation and great prostration.

Local treatment directed to the umbilicus in those cases in

which there is evidence of inflammation of the umbilicus or umbilical vessels should not be neglected. Venisection of the umbilicus, and the application of poultices to it, have been followed by unquestionable benefit, if we may believe the statement of some physicians who have made use of these measures. Dr. Merriweather, of Alabama, says, if there is no improvement from the medicine which he orders, he applies a blister, larger than a dollar, to the umbilicus, and with this treatment the child generally improves; a remarkable statement, since so few improve at all.

A warm foot-bath repeated at intervals of a few hours, and stimulating embrocations along the spine are proper adjuvants to the treatment.

CHAPTER XIII.

INTERNAL CONVULSIONS.

YOUNG children are liable to temporary suspension of respiration induced by violent emotions, especially by anger. In the midst of their excitement, while they are crying or screaming, their breath is suddenly held as if from tonic spasm of the respiratory muscles. In a few seconds respiration returns, and is natural. There is no stridulous inspiration or other unusual sound, and there is no apparent ill effect, unless occasionally a degree of languor. External convulsions, which seem to be threatening, seldom occur, and when they do, are ordinarily mild. Some writers consider dentition the predisposing cause of this arrest of respiration by inducing a sensitive state of the nervous system. Such an effect of dentition is possible, but certainly many infants are liable to this temporary suspension of breathing before the age of dentition.

A much more serious state, and one which is recognized as a true disease, is that variously designated by writers as internal convulsions, spasm of the glottis, child-crowing, laryngismus stridulus, &c. Manifest difficulties attend the investigation of the pathological state in this disease. There can be little doubt

that it is not precisely the same in all cases. That there is, during the paroxysms, tonic or clonic spasm of more or fewer of the respiratory muscles is inferred, not only from the symptoms pertaining to the respiratory apparatus, but from the fact that in severe cases there are often spasms of the external muscles, as those of the limbs and face. Usually, also, the movements of the eyeballs indicate spasmodic contractions of the motor muscles of the eyes. The occurrence of these contractions in parts that are visible justify the belief that they occur in other parts which are concealed from view, especially as the characteristic symptoms cannot be readily explained except on this supposition. Trousseau says: "Internal convulsions consist, then, principally in a spasm of the diaphragm and of the respiratory muscles of the abdomen and chest; but it happens, also, that the muscles pertaining to the larynx are affected with spasm at the same time with these." Rilliet and Barther conclude from the symptoms that the "heart is not always a stranger to this internal convulsion, which, perhaps, prolongs itself even to the intestines. The muscles of the pharynx appear to be involved, in some cases, as well as those of respiration, rendering deglutition difficult. In one form of internal convulsions, namely, that which is principally referred to by writers, there is not complete arrest of respiration, but the inspirations, during the paroxysm, are difficult and are attended by a stridulous noise. Again, the respiration may cease entirely, but when it commences it is stridulous, and difficult for a few inspirations. In still another form of the disease respiration ceases, but there is no symptom or sign indicative of glottic spasm or of an obstacle to the ingress of air; the inspirations which succeed the paroxysm are easy and noiseless. It has been suggested that, in these cases, there is paralysis rather than spasmodic contraction of the respiratory muscles, but the symptoms may be explained in accordance with the commonly accepted opinion, namely, that there is spasm of the diaphragm and, perhaps, some of the muscles of the chest and abdomen, while the laryngeal muscles are not affected. M. Herard, indeed, who has written one of the best monographs on internal convulsions, describes three forms of the disease, according to the supposed location of the spasm, namely, laryngeal, diaphragmatic, and a third, which consists of a blending of the two.

Internal convulsions are not frequent in this country; they are

rare in France, more frequent in Germany, and quite common in England. They occur, with few exceptions, before the age of two years. Dr. West observed thirty-one cases under the age of two years and only six above that age.

CAUSES.—The causes of internal convulsions are not fully ascertained. Most observers have remarked the relative frequency of the disease during the period of dentition, and it is probable that dental evolution does operate as a cause, by rendering the nervous system more impressible.

Spasm of the glottis has been attributed to enlargement of the thymus gland, and also to enlargement of the cervical and bronchial glands. It is presumed that this effect is due to the pressure of these glands on the par vagum, or the recurrent laryngeal nerve. It is certain, however, that there is no such enlargement of the thymus gland which could possibly produce glottic spasm, or any other form of internal convulsions at the age at which these convulsions commonly occur. This gland is largest in the newborn, and having no function after birth, it gradually becomes atrophied. If enlarged thymus could produce glottic spasm, it would certainly occur most frequently in the new-born. Abnormal development of the thymus has seemed to me to be the cause of atelectasis in two infants who died soon after birth, but I have never seen a case in which a convulsive attack was referable to this cause. M. Herard examined the thymus gland in six children who died of internal convulsions, and in sixty who died of other affections, and was not able to discover in its condition any causative relation to this disease. Indeed, cases have been reported in which the thymus had undergone more than its usual atrophy at the time when the convulsions occurred (Häser). Enlargements of the lymphatic glands in the vicinity of the pneumogastric or recurrent laryngeal nerve may possibly give rise to glottic spasm, but this is doubtless an infrequent cause, if it be a cause at all, since these glands are often greatly enlarged in strumous and tubercular diseases without such a result. According to Dr. Jacobs (*N. Y. Journ. of Med.*, Jan. 1860): "In some cases described by Dr. Friedleben, a congenital hypertrophy of the thyroid gland has probably been the cause of laryngismus. The patients were new-born infants of normal development, and born by normal labors. There were no constitutional causes of the disease, but a remarkable vascular swelling of the thyroid

gland. Whenever the swelling increased, the veins of the face and head increased in size also, the face grew livid, and the extremities and spinal column exhibited slight tonic convulsions. The recurrent nerves were entirely surrounded by the glandular tissue, their neurilemma looked unusually red, and their functions were probably injured during the occasional swelling taking place during lifetime."

The cause is occasionally located in the cerebro-spinal axis. Thus Dr. Coley relates a case in which an exostosis arising from the internal surface of the occipital bone pressed upon the cerebellum, while nothing abnormal was discovered in other organs. There are also striking examples in which the cause was located in the spinal cord. Thus Marshall Hall relates the following case communicated to him. A child with *spina bifida* was attacked with croup-like convulsions, whenever it lay so as to press on the tumor.

In some patients there is evidently an hereditary predisposition to this disease; those affected belonging to families in which there is a tendency to convulsive affections. Thus Toogood relates that five infants of the same family were affected with spasm of the glottis; and Reid relates on the authority of Powell that of thirteen infants of the same parents only one escaped interlial convulsions.

The common predisposing cause is an excitable state of the nervous system, often associated with impaired general health. Hence the disease is more prevalent in cities where anti-hygienic conditions abound than in the country. Hence, too, the frequent improvement when the patient is removed to the pure and bracing air of the country. The use of insufficient food, or food of a bad quality must for the same reason be considered a cause, as it leads to impoverishment of the blood, and renders the nervous system more impressible. Facts mentioned by Reid and others show conclusively the influence of premature weaning, and of indigestible or otherwise improper aliment in the production of this disease.

The causes enumerated above are for the most part predisposing; occasionally they are the only apparent causes, since this disease sometimes occurs when the child is perfectly tranquil, even in the midst of quiet sleep, or when it is at rest in its mother's arms. In other cases, and more frequently, there is an

exciting cause, often trivial. Anything that requires exertion on the part of the infant, or that excites strong emotions, may be a direct cause, as anger, or any of the violent passions; so may even coughing, or, in rare instances, attempts to swallow. One author has known it to occur from excitement produced by examining the throat with a spoon. In a case in my practice, hereafter related, it occurred whenever the infant cried violently. It appears from the above facts that the etiology of internal convulsions is very similar to that of eclampsia. The same spasmodic muscular contraction may occur from a variety of causes.

ANATOMICAL CHARACTERS.—While, therefore, structural changes in various parts of the system may give rise to internal convulsions, this disease, as regards the state of the muscles of respiration and the respiratory system, must be regarded as *neurotic*. The lesions of the respiratory apparatus, observed at post-mortem examinations, are either due to the convulsions or are coincidences. Emphysema has sometimes been observed as a result, it is believed, of the spasmodic and irregular respiration. It was present in all of Herard's cases, and Billiet and Barthès consider it common in those who die of this affection, although they did not observe it in any of their cases. Slight emphysema occurring in the upper lobes is, however, common in infants, even those who have had no serious disease of the respiratory organs. From the frequency with which I have observed it at autopsies, I have been led to think that it is sometimes produced in a state of health, by forcible and irregular respiration, as in crying.

In fatal cases of internal convulsions, the blood is darker than usual, from an excess of carbonic acid; the cavities of the heart and large vessels are sometimes engorged with blood, but in other cases, they contain no more than the normal amount. More or less passive congestion occurs in the internal organs; the congestion of the cerebral vessels is sometimes such that serous effusion occurs.

SYMPTOMS.—I have said that the symptoms vary according to the seat and function of the muscles which are affected. There is generally previous ill health. The child is drooping, and is sometimes restless for days before the disease appears. Finally, if the muscles of the glottis become affected, the peculiar crowing sound is heard now and then during inspiration. It is observed,

especially, when the child is crying or is agitated. It may be loud and well defined from the first, but in most patients it comes on gradually, so that several days elapse before its full stridulous character is developed. The attacks are more frequent and severe at night, in or after the first sleep, than in the daytime.

Under favorable hygienic conditions, the disease may pass off without becoming more serious. In other cases, the paroxysms gradually increase in frequency and severity. The dyspnoea in the attack is such that the features are livid, the head forcibly retracted, and death seems imminent from apnoea. In these severe paroxysms respiration often ceases entirely for a moment. When the spasm ends, a deep stridulous inspiration occurs, after which the breathing is natural. It has been stated that internal convulsions are often associated with those, usually tonic, but sometimes clonic, of the external muscles. In the tonic form, the thumbs are flexed across the palms of the hands, and, sometimes, are grasped by the fingers; the great toes are adducted, and the other toes flexed. In severe cases, the hands, forearms, feet, and legs, are also somewhat flexed and rigid. At first, the contraction of the external muscles is temporary, either corresponding with the internal spasm, or it is most intense at the time of the spasm, though commencing sooner and subsiding later. After a while, however, if the disease continues, the external contraction becomes more persistent. In severe cases, nearly every inspiration is accompanied by the wheezing sound, and the paroxysms of dyspnoea are excited by trifling causes. Anything that suddenly disturbs the mind or body may bring on the attack, as anger, the impression of cold, or currents of air. Dr. West calls attention to the fact, that an anasarctous condition is sometimes present accompanied by albuminuria. Passive congestion of the kidney will, doubtless, give rise to albuminuria, and of the systemic capillaries to anasarca.

If the convulsions affect other muscles, as the diaphragm or the pectoral and abdominal muscles, which are concerned in the respiratory function, while those of the larynx escape, respiration is irregular, or even suspended for a moment, but the stridulous laryngeal sound is absent, as there is no obstacle in the larynx to the entrance of air. In this form of the disease, the inframammary region may be strongly retracted during the paroxysm from tonic contraction of the diaphragm. In severe

paroxysms, whether the spasm be laryngeal or diaphragmatic, consciousness is nearly or quite lost, the features may be pallid, or, if respiration be suspended, may be more or less livid. There is no fever in simple cases. In the paroxysm there is often relaxation of the sphincters of the bowels and bladder, with involuntary evacuations.

The duration of the paroxysm may be a quarter, a half, or even a whole minute. Total suspension of respiration for even half a minute involves great danger. In mild cases, there may be but few paroxysms, and they slight. In other instances, they occur even in a severe form, almost daily for several weeks or even months. In the following case the muscles of the larynx were apparently not involved. The patient was scrofulous, and has since had scrofulous pericostitis, with necrosis and exfoliation of the surface of the tibia. At the time of the internal convulsions, there was also a scorbutic or hemorrhagic cachexia.

CASE.—On the 28th of August, 1858, a German female infant, fourteen months old, nursing, and having eight teeth, was suddenly seized with clonic convulsions. Uniformly delicate and pale, she had been in her usual health till the age of twelve months, when she had a single convulsive attack, and from that date had remained well till August 27, when, without any premonitory symptom, she had a stool consisting of almost pure blood, black and offensive. On the morning of the 28th a similar evacuation occurred, and another in the afternoon immediately preceding the convulsion. Pulse 128, after the convulsion; surface cool and pallid; flesh soft, but no emaciation. Turpentine was prescribed in two-drop doses every two hours, and linaclium in one and a half drop doses repeated sufficiently to insure quietude.

On the 29th the pulse was 112. At 1 P. M. she had a general convulsion, lasting about five minutes; in the evening she had an evacuation similar to those passed on the preceding day. The record for August 30, states: "Pulse from 150 to 160; up to this time has been playful, but is now drowsy, and, when disturbed, fretful; manifests no desire for solid food, as before her sickness, but still nurses; has taken up to this time thirty-two drops of turpentine. When she cries or frets she has a spasmodic attack." This was the commencement of internal convulsions, with which this child was affected for several months. An opportunity was afforded of observing their character, for her excitement, when she was examined, was usually sufficient to produce them. After a succession of short expirations, respiration ceased; for a moment she was apparently insensible; eyes closed; face pale; no frothing at the mouth. The return of consciousness and respiration was without any laryngeal rale; and after the attack she seemed as well as before. No external convulsion, and no evacuation of blood occurred after August 31.

There was gradual improvement in her health, but she continued

for many months pallid and irritable, and subject to attacks of internal convulsions. On the 11th of April, 1859, when twenty-two months old, she had another attack of general convulsions. The record made on that day is: "Has had internal convulsions (one or more paroxysms) almost every day since last August, brought on usually by crying when she is corrected in any way, or her wishes are refused." Again, on Dec. 1, 1859, it is stated: "Has grown considerably since the last record, and appears to have recovered, except that at long intervals the spasms still occur." She took a preparation of iron, but her recovery seemed to be due more to the growth and development of the body, and to hygienic than therapeutic measures.

The general health in internal convulsions is more or less impaired, except in mild forms of the disease, in which the convulsive attacks soon cease. Pallor, or a sickly and cachectic aspect; poor appetite; irregular, usually constipated bowels; moroseness or irritability of temper, are common symptoms of severe and protracted cases.

DIAGNOSIS.—This disease is easily diagnosed, unless when its symptoms are masked by those of external convulsions; it may then escape notice. Spasms of the glottis may be mistaken for spasmodic laryngitis, and vice versa. A case communicated by Dr. Pepper to Dr. Meigs, and published by the latter in his work on diseases of children, is evidently, as Prof. Jacobi has remarked, wrongly diagnosed. Spasmodic laryngitis is, however, so different not only in its nature, but in its clinical history, that a differential diagnosis is not difficult. It is an inflammatory disease, and is attended with febrile reaction and a sonorous cough; it commences at night after the first sleep, and from exposure to cold—particulars, in regard to which it contrasts with true spasms of the glottis.

PROGNOSIS. MODES OF DEATH.—Statistics show great mortality in this disease. Dr. Reid, in a monograph on "Infantile Laryngismus," states that of 289 cases which he collated, 115 died. Billiet and Barthez met with one favorable case in nine unfavorable; and Herard one in seven. If the paroxysms are mild, infrequent, and dependent on a cause which can be easily removed, recovery is probable with proper treatment. The cause may, however, be such, even when the spasm is mild, that the case is necessarily unfavorable; as when it is due to disease of the cerebro-spinal centre. We should not, however, in any case consider the patient entirely safe, since grave symptoms may

suddenly arise, so as to wholly change the prognosis. Long and severe paroxysms, with lividity of the face, and symptoms of suffocation, indicate an unfavorable result. The same should be predicted also if the infant gradually waste away, losing appetite and strength, especially if the face is pale, and the pulæ feeble.

There are three modes of death in internal convulsions: the first apnea. The infant dies suffocated in the attack. Respiration is first arrested, and then the pulse ceases, and at the autopsy the lungs and the cavities of the heart are found engorged with dark blood. Death may also occur from the state of the brain. In such cases, passive congestion of the brain occurs from obstruction to the return of blood from this organ to the heart and lungs; and if this congestion is not soon relieved, serous effusion also occurs. The fatal result is due to the congestion and effusion.

The third mode of death is from exhaustion. Repeated and severe attacks undermine the constitution; the infant grows pale and thin gradually, and dies of pure inanition, or of some disease which this state induces.

TREATMENT.—The treatment of this disease has varied according to the theories which physicians have held in reference to its cause. Glandular enlargement is no longer regarded as a common cause, and therefore treatment directed to its removal is less frequently employed than formerly. The causes of internal convulsions are in part very similar to those of eclampsia, and the remedies employed in the one affection are, in a measure, appropriate in the other. That dentition is sometimes a cause, is usually admitted; and two cases, one of which occurred in my practice, and the other was reported to me, clearly show the truth of this belief. The effect of dentition is especially observed in weakly infants, when several dental follicles are undergoing active evolution. Thus, in one of the cases to which I refer, five teeth pierced the gums in the course of two weeks; after which no convulsive attack occurred. If, therefore, the gums are swollen, scarification is proper.

In all cases of internal convulsions, a careful examination should be made in order to detect any approachable cause of nervous excitation. The condition of the digestive organs should be ascertained, and emetics or other remedies prescribed if there is evidence of their derangement.

Sometimes the alimentation of the infant is defective. It is, perhaps, bottle-feeding, and the stools have an unhealthy appearance. Greater attention should be given to the preparation of its food, and the times of its feeding; or, if it receive plain but nutritious diet, and the utmost regularity of life should be required of the nurse, and regularity in giving the infant the breast. If there is a torpid state of the bowels, Dr. Meigs recommends "castor-oil and aromatic syrup of rhubarb rubbed up together, three parts of the former and five of the latter." A simple emema answers well in such cases, and, in debilitated infants, this is preferable to medicine administered by the mouth. If there be diarrhoea, and it persist after the requisite changes are made in regard to the diet, remedies calculated to relieve it, and which are detailed elsewhere, should be employed. Marshall Hall states that he has ordinarily succeeded in curing the disease by attending to the condition of the lungs and digestive organs.

In pallid and cachectic infants, tonics are required. The elixir of Calisaya bark in half-teaspoonful doses, three or four times daily, to an infant of one year, is an eligible preparation. The compound tincture of bark, or of gentian, or the two mixed, may be given instead of the Calisaya bark. The preparations of iron are sometimes to be preferred. The best of these are the syrup of iodide of iron, tincture of iron, or the wine of iron. To an infant of one year the syrup may be given in doses of four drops, the tincture of two drops, and the wine in doses of one teaspoonful, three times daily. If the child is old enough, it may take iron in lozenges, as those of chocolate and iron.

Antispasmodics, as nuxvomita, valerian, and oxide of zinc, are often prescribed in this disease, but they are less reliable than the general tonic measures which I have indicated. The salutary effect of bromide of potassium in eclampsia, and certain epileptiform attacks, certainly justifies the trial of this agent in internal convulsions, if they persist notwithstanding the employment of invigorating measures.

Hygienic measures are of the utmost importance. The infant should reside in dry and airy apartments, and should be kept much of the time through the day in the open air. Remarkable success sometimes attends this simple expedient, when medicines have entirely failed. In the *London Med. Gazette*, Jan. 14, 1865, Mr. Robertson, of Manchester, relates five severe cases in which

this disease was cured by exposure of the infants several hours daily to a cool atmosphere. These cases were treated in the winter months, and were kept out door, even during strong winds. Mr. Robertson has records of forty cases, all occurring between December and April, while he has seen no case in the summer months. As the result of such extensive experience this writer recommends "the free exposure of the infant out of doors, for many hours daily, to a dry, cold atmosphere, and if the air be dry, the colder the better." Dr. Marshall Hall's experience was similar. Says he: "The curative influence of change of air, and especially of the sea-breezes, are not less marked in this affection than in whooping-cough." Mr. Robertson recommends also, as part of the tonic treatment, "free sponging of the body every morning with cold water." In February, 1867, I attended a nursing infant five months old with internal convulsions, the paroxysms being attended with lividity of the face, and, at times, tonic convulsions of the limbs. Among the remedies employed was bromide of potassium, but more benefit obviously accrued from keeping the infant much of the time in the open air, than from the medicines employed. The disease passed off in six or eight weeks.

Unless the cause is of such a nature that it cannot be removed, the above hygienic and therapeutic measures will, in a large proportion of cases, be followed by a satisfactory result.

The mother or nurse may abridge the paroxysm by raising the infant, blowing upon it, sprinkling water in the face, or gently stroking it. Dr. Hall recommends tickling the nostrils with a feather, to produce respiration, or the fancies to occasion vomiting, and thereby interrupt the paroxysm. Anything which produces a sudden and profound effect upon the system may abridge the attack. This was effected in one case in the practice of Dr. C. D. Meigs, by applying a cloth wrappd around ice over the epigastrium, and the lower part of the sternum. The chief danger during the attack is from congestion of the brain, with serous effusion or extravasation of blood. If the attack is severe, and the features congested, so that there is evident danger of such a result, cold applications should be made to the head, derivatives used for the extremities—as sinapisms, or mustard foot-baths—and the bowels should be speedily opened by emetics.

SECTION II.

DISEASES OF THE RESPIRATORY SYSTEM.

CHAPTER I.

CORYZA.

THE term coryza is applied to inflammation of the Schneiderian membrane. It is acute or chronic. The acute form is primary or secondary. Acute primary coryza is common in infancy and childhood. Its usual cause is exposure to currents of air, to cold, and especially to sudden changes of temperature from warm to cold. The cause is the same as that in the ordinary forms of bronchitis. These two diseases frequently indeed coexist, occurring from the same exposure. The inflammation in such cases commences upon the Schneiderian membrane, immediately upon the operation of the cause, and soon after affects the bronchial tubes.

Secondary coryza is commonly due to a specific virus. The diseases in connection with which it occurs are whooping-cough, measles, scarlet fever, diphtheria, and constitutional syphilis. In the infant, coryza is one of the first manifestations of hereditary syphilitic taint.

Acute primary coryza ordinarily abates in from one to two weeks. The secondary form gradually declines, in most cases, when the primary affection on which it depends is cured. Syphilitic coryza is more protracted than the primary form, or than that accompanying the eruptive fevers. Some children are so liable to coryza that it occurs whenever they take cold. It is in them so frequently renewed in the winter months, that it seems almost to be chronic.

Chronic coryza is commonly dependent on a dyscrasia. It oc-

responds with chronic inflammation of the external ear which gives rise to *otorrhoea*. *Otorrhoea* is, indeed, not infrequent in the class of children in whom this form of coryza occurs. The dyscrasia is indicated by pallor, flabbiness of the flesh, and liability to glandular swellings. Chronic coryza may also occur in those who have good general health, as the result of an acute attack. Many a case dates back to one of the exanthematic fevers, the local affection continuing after the general health is restored. Rarely chronic coryza comes on gradually and without appreciable cause.

ANATOMICAL CHARACTERS.—The alterations which the nasal mucous membrane undergoes when inflamed, vary considerably in different cases. In the simplest and most common form of coryza, the mucous membrane is sometimes in patches, sometimes generally reddened, thickened, and softened. The papillae are prominent, producing an inequality of the surface. Ulcerations are not common in simple acute coryza, but they sometimes occur in the chronic form.

In diphtheria, and not infrequently in scarlet fever and variola, the coryza is pseudo-membranous, and when it presents this form it is associated with pseudo-membranous angina or laryngitis. A case of pseudo-membranous coryza occurring in measles, is related by M. Guibert. The patient was a rachitic boy, three and a half years old. The pseudo-membrane, in severe cases, may cover almost the entire surface of the nostrils, but ordinarily it occurs in patches.

SYMPTOMS.—The general or constitutional symptoms are mild or severe, according to the gravity of the inflammation. If the coryza is acute and pretty general, there is febrile movement with thirst and loss of appetite. Frontal headache is common, from the proximity of the inflammation to the head, or extension of the inflammation to the frontal sinuses. Sneezing is the first symptom in many cases of acute coryza. As the inflamed membrane swells, more or less obstruction occurs to respiration. The breathing is noisy, especially during sleep, and, in severe cases, the patient is compelled to breathe mostly through the mouth. If there is much obstruction to respiration, the suffering of the patient is considerable, from the sensation of fulness in the nostrils, the headache, and the muscular effort required in each respiratory act.

In the commencement of coryza, a thin discharge occurs from the nostrils, of a serous appearance. In the course of a few hours the secretion becomes thicker. It is mucopurulent, and remains such till the disease begins to decline. Inguisated mucus and crusts are apt to collect within the nostrils and around their orifice in chronic coryza, and sometimes also in acute coryza, if the discharge is not abundant. These crusts increase the difficulty of breathing. Often the acridity of the discharge is such that the skin of the upper lip, and that surrounding the nostrils, is excoriated.

PROGNOSIS.—Simple, uncomplicated coryza rarely terminates fatally. It is only dangerous in young nursing infants, in whom it may seriously interfere with lactation. Coryza, accompanying the eruptive fevers, although it may increase the suffering, does not materially increase the danger. Syphilitic coryza subsides when the system is sufficiently affected by anti-syphilitic remedies. Chronic coryza is sometimes very obstinate. It may continue for months or years, giving rise to a constant, but often not abundant, discharge like the otorrhœa, which it so much resembles, both as regards cause and nature.

TREATMENT.—Common mild attacks of coryza require little treatment. The bowels should be kept open, the feet soaked in mustard water, and the body should be warmly clothed. Some benefit may be derived from friction with camphorated oil over the nose. If coryza commences with symptoms which indicate a pretty severe attack, and there are evidences of extension of the disease towards the bronchial tubes, an emetic of syrup of ipecacuanha, given at an early period, moderates the severity of the inflammation and may prevent the recurrence of bronchitis. Afterwards, a simple diaphoretic mixture, as the following, should be given:—

R.—Syrup*i*pecacuanha ℥j;
 Spirit. ether. nitr. ℥j;
 Syrup*i*singlcis ℥j.
 M*isc*.

One teaspoonful every three hours to a child of six months. In place of sweet spirits of nitre acetate of potash may be employed in the dose of one to two grains for infants; and if there is decided febrile reaction, from half a grain to two grains, according to the age, of tincture of digitalis, may be given in each dose.

In pseudo-membranous coryza the main treatment must be directed to the accompanying laryngitis if, as is usual, the latter affection is present, since the coryza is much less dangerous than the other inflammation. Still, if it cause any obstruction to the respiration and increase the suffering of the patient, it requires attention. The frequent injection into the nostril of a solution of chlorate of potash in water exerts a beneficial effect upon the inflammation, and aids in removing the accumulation of fibrin, mucus, and pus. It should be employed several times in the course of the day. Alum injections, four or five grains to the ounce of water, are also useful in a certain proportion of cases; or a solution of one of the mineral astringents may be employed, as liquor ferri sulphatis, acetate of lead, sulphate of copper, or nitrate of silver. The bromine solution described in our remarks on the treatment of croup will also be found useful injected into the nostrils.

In most cases of pseudo-membranous coryza constitutional measures are requisite, on account of the disease with which it is associated. In cases of acute simple coryza, and in the pseudo-membranous, inhalation, through the nostrils, of the vapor of hot water or of steam from hops often gives relief; occasionally it is an important part of the treatment. Syphilitic coryza requires those measures which are appropriate for constitutional syphilis.

Chronic coryza, dependent on a dyscrasia, is best treated by tonic and alterative remedies. The various ferruginous preparations, as wine of iron, tincture of the chloride of iron, iron lozenges, may be advantageously employed, or the vegetable tonics. If there are pallor, softness of flesh, and especially glandular swellings, indicating a scrofulous state of system, the liquor ferri iodidi is most useful, with or without cod-liver oil. The diet should be nutritious, and the hygienic measures such as invigorate the general health. Injections into the nostrils of a solution of alum, five grains to the ounce, of nitrate of silver, three to five grains to the ounce, or of one of the other mineral astringents, are required in conjunction with constitutional measures. An excellent formula for application to parts which can be reached by a camel's hair pencil is the following:—

R.—*Palmitis acid* \mathfrak{ss} i.
Glycerine \mathfrak{ss} .
Mise.

This should be applied three or four times daily. Dr. J. P. Meigs, of Philadelphia, recommends the following ointment in chronic coryza, to be applied at night, after the use of injections through the day:—

R.—Unguenti hydragryi citratis ℥ss;
 Extracti belladonnæ gr. x;
 Amygdal. ℥ss.
 Mice.

"It should be applied," says Dr. Meigs, "after being completely softened by a gentle heat, on a camel's hair pencil, care being taken to apply it thoroughly to the surface of the mucous membrane itself, and not merely to the outside of the hardened scabs."

CHAPTER II.

SIMPLE LARYNGITIS.

SIMPLE acute laryngitis occurs at all ages, but it is so common in infancy and childhood that it should be described in a treatise on the diseases of this age. Like the other inflammatory affections of the air passages, it is most common in the cold months or when the weather is changeable. Its usual cause is, therefore, exposure to cold. In the young infant crying, protracted and violent, is an occasional cause. Simple or erythematous laryngitis also occurs in connection with certain other diseases, among which may be mentioned measles, scarlatina, and variola. In most cases of bronchitis, also, and in many of pneumonia, there is laryngitis, though its symptoms are, in great measure, obscured by those of the graver affection.

SYMPTOMS.—In most cases of simple or erythematous laryngitis, which are due to the impression of cold, coryza precedes and accompanies the attack. The first symptom is chilliness, accompanied sometimes by sneezing, which is referable to the coryza. The commencement of laryngitis is indicated by hoarseness, which is apparent when the child cries, or, if old enough, when he attempts to speak. There is, in severe cases, often complete loss of voice, so that the child cannot speak above a whisper. I have noticed this most frequently in the laryngitis which accompanies measles. Cough is also a common symptom of this disease,

It is at first dry and husky, but it becomes loose in the course of a few days. It is often accompanied by soreness of the throat, noticed especially in the act of coughing or when the larynx is pressed with the finger. In simple laryngitis, when uncomplicated, the respiration remains nearly natural and the pulse is but little accelerated. In mild cases the nature of the disease is often not apparent as long as the child remains quiet, in consequence of the absence of symptoms, but the character of the voice, when he cries or speaks, or of the cough, reveals at once the nature of the affection.

Simple acute laryngitis subsides in from one to two weeks. Occasionally it lasts three or four weeks before the cough entirely disappears. Death, which is rare, is attributable to some complication.

CHRONIC laryngitis is much less frequent than the acute form. Its anatomical characters are similar to those in other chronic inflammations affecting mucous surfaces, namely, thickening, and more or less infiltration of the mucous membrane; increased proliferation and exfoliation of the epithelial cells, and increased functional activity of the muciparous follicles.

In the adult chronic laryngitis is dependent on the syphilis or tubercular disease. In the child it occurs not infrequently in connection with tubercles in the lungs or bronchial glands. Such patients are emaciated, and have the ordinary symptoms of tuberculosis. But occasionally chronic laryngitis occurs in young children, usually infants in whom there is no emaciation or other evidence of cachexia. I have records of about twelve such cases, mostly nursing infants. Some of these patients had mild bronchitis, but it was obviously subordinate to the laryngitis. Their respiration was noisy and harsh, continuing of this character day after day and week after week. The cough was also harsh and loud, conveying the idea of thickening, and relaxation of the mucous membrane covering the vocal cords. Their respiration was not notably accelerated, and the blood was apparently fully oxygenated, though the friends were often alarmed by the noisy breathing and cough.

In this form of chronic laryngitis there is little expectoration, the fever is slight or absent, the appetite remains unimpaired, and the general condition of the child is good. There are from time to time exacerbations, and occasionally improvement is such as to encourage the hope of speedy cure, but in the cases which I

have seen, there has not been complete intermission in the disease till the final recovery. Those patients whom I have been able to follow through the disease have recovered in from three or four months to one year.

This chronic laryngitis is to be distinguished from frequent attacks of acute laryngitis, which are due to fresh exposures, and are accompanied by the ordinary symptoms of the acute disease. It is to be distinguished from protracted acute laryngitis, which sometimes does not entirely subside in less than a month or six weeks, by its longer duration, the greater thickening of the inflamed membrane, and consequently more noisy respiration. In some of the cases of chronic laryngitis which I have seen, this disease evidently resulted from an acute attack.

ANATOMICAL CHARACTERS.—In simple acute laryngitis the mucous membrane of the larynx presents the usual appearance of mucous surfaces when inflamed, namely, redness and thickening. It is also somewhat softened. Ulcerations rarely, perhaps never, occur in primary acute laryngitis. When present, they are, with few exceptions, referable to the tubercular or syphilitic cachexia. They are small, and are situated upon or near the vocal cords. The inflammation in simple acute laryngitis usually extends over the whole surface of the larynx, and also to the upper part of the trachea. It may be pretty uniform or more intense in one place than another, and like other mucous inflammations it is accompanied by more or less rapid proliferation and exfoliation of epithelial cells. In most cases of simple laryngitis, whether acute or chronic, the inflammation extends to the fauces producing redness and thickening, though generally moderate, of the mucous membrane which covers it. Examination of the fauces therefore aids in diagnosis.

In the adult oedema glottidis occasionally results from laryngitis. In the child there is little danger that this will occur in consequence of the anatomical character of the larynx. In early life there is but little submucous areolar tissue in the larynx, and therefore less submucous infiltration or effusion during inflammation. The structural changes occurring in the laryngitis of infancy and childhood relate almost exclusively to the mucous membrane.

TREATMENT.—Simple primary and uncomplicated laryngitis requires little treatment. Most cases would do well by the em-

ployment of suitable hygienic measures without medicines. Benefit is, however, derived from the use of demulcent drinks, and an occasional laxative. A mixture of purgative and syrup of ipsema, or a small Dover's powder, will relieve the cough if it is troublesome. If there is restlessness, a warm mustard foot-bath is useful. An important part of the treatment is the application of some mild counter-irritant over the larynx. In most instances camphorated oil, preceded perhaps by mustard, produces sufficient irritation. It should be rubbed several times daily over the throat, or a strip of flannel soaked with it may be applied around the neck. Chronic laryngitis dependent on syphilis or tuberculosis requires the constitutional treatment which is appropriate for that disease. Local measures have but little effect upon this form of inflammation. The chronic laryngitis which I have described as occurring in those who have good general health, and which, sometimes, results from an acute attack of the disease, is a very obstinate affection. The patient should be warmly clothed, and constant care should be taken that there be no exposure, which would endanger taking cold, as this would inevitably produce an exacerbation of the disease, and counteract all that had been gained by remedial measures. This form of chronic laryngitis is most satisfactorily treated by the application of tincture of iodine upon the neck, directly over the larynx, and in some cases a solution of nitrate of silver, ten or twenty grains to the ounce, to the flannel, so that, if possible, some of it may enter the larynx. Little benefit results in this disease from the usual expectorant remedies, as squills or senega. In the last cases which I have treated, I have employed the fluid extract of cubeba, one to three drops three or four times daily in simple syrup. It has seemed to be more beneficial than other medicines, though I have not employed it sufficiently to speak with positiveness of its effects. Alterative preparations, as the iodides, may be useful in certain cases.

Spasmodic Laryngitis.

This is a common disease. It is also called false croup, in contradistinction to true or pseudo-membranous croup, and, by some of the continental writers, stridulous angina, or stridulous laryngitis. It should not be confounded with spasm of the glottis,

which is a form of internal convulsions, and is not inflammatory. It occurs ordinarily between the ages of two and five years. It is commonly a sporadic affection, but Billiet and Barthez state that "it is incontestable that it may prevail epidemically." They express this opinion, not from their own observations, but chiefly from those of Jurine, made in the commencement of the present century.

CAUSES.—Children, in some families, are more liable to false croup than in others, so that an hereditary liability to it must be admitted. The exciting cause in most cases is exposure to cold. False croup is not uncommon in the commencement of measles. Narrowness of the rima glottidis, and an excitable state of the nervous system, both of which are common in early childhood, are predisposing causes.

SYMPTOMS.—Spasmodic laryngitis is ordinarily preceded for a day or two by a slight cough and fever, by symptoms of mild coryza or catarrh, such as all children are liable to on taking cold. In exceptional cases, these symptoms are absent, and the disease begins abruptly. Singularly, it commences nearly always at night, after the first sleep, between ten and twelve o'clock. The sleep is usually quiet and natural, but the child awakens with a loud barking cough. There is great dyspnoea, and the respiration is harsh or whistling, on account of the narrowing of the rima glottidis from the swelling and tension of the vocal cords. The face is flushed and indicative of suffering. The child cries, moves from one position to another; wishes to be held or carried, seeking in vain for relief. The skin is hot, pulse accelerated, the voice hoarse or even whispering. After a variable period, usually from half an hour to two or three—not more than half an hour with proper treatment—these symptoms abate. The patient is then somewhat exhausted, and falls asleep. The face is less flushed or even pallid, the heat abates, and the pulse is less accelerated. The cough, though less frequent, remains for a time, barking or sonorous, and the respiration, though greatly relieved, is not at once entirely natural, but it gradually becomes so. Often there is no return of the spasmodic respiration and cough, but sometimes the attack is repeated once or more, especially during the subsequent nights. The symptoms vary greatly in intensity in different patients.

As the attack declines, the disease, losing its spasmodic charac-

ter, becomes a simple inflammation. In some there is immediate return to perfect health, but oftener the inflammation extends not only into the trachea but also into the larger bronchial tubes, and the disease is then a laryngo-bronchitis, which gradually subsides.

The termination is not always so favorable. Spasmodic laryngitis is, in exceptional instances, the precursor of other serious affections, which may prove fatal. It has been stated that measles often begins with spasmodic laryngitis. Bronchitis becoming capillary, may occur in connection with it, as may also pneumonia, and by either of these severe inflammations the prognosis may be rendered doubtful. There are a few cases on record in which it is believed that spasmodic laryngitis was of itself fatal. In some of these cases the dyspnea was extreme and persistent, and was the cause of death. In a case reported by Rogers, on the other hand, the respiration became easy before death, and the pulse more and more frequent and feeble. Death apparently occurred from exhaustion. It is not improbable that had thorough post-mortem examinations been made, in those cases of spasmodic laryngitis which have ended fatally, other lesions would have been discovered besides those located in the larynx, perhaps tracheo-bronchitis, with an accumulation of mucus in the larynx, producing suffocation, or perhaps sometimes congestion of the brain or lungs and serous effusion.

ANATOMICAL CHARACTER; PATHOLOGY.—The opportunity does not often occur of determining the anatomical characters of spasmodic laryngitis. I have seen but one post-mortem examination. A little girl, nine years old, was taken on Friday night with cough and dyspnea, indicating a pretty severe attack. The mother, acting through the advice of a friend, gave kerosene oil to her in considerable quantity. This was succeeded by obstinate vomiting and purging, which continued during Saturday and Sunday. Death occurred on Monday. At the autopsy we found uniform and intense injection throughout the whole extent of the larynx and trachea, and extending into the bronchial tubes. There was no fibrin on the inflamed surface, and but little mucus and pus. The solitary follicles of the intestines and Peyer's patches were tumefied. There was injection in places of the gastro-intestinal mucous membrane. The cause of death was obviously the diarrhoea, apparently of an inflammatory character, whether or not produced by the kerosene. The condition of the

mucous membrane of the larynx was that which is ordinarily present in spasmodic laryngitis, though in some cases in which post-mortem examinations have been made, the evidences of laryngeal inflammation were slight. Guersant relates a case in which the surface of the larynx seemed to be nearly in its normal state. Death in cases of slight laryngitis is due to causes which are independent of the larynx. In Guersant's cases there was tuberculosis.

There is, as has already been intimated, another and an important element besides the inflammation, in the pathology of spasmodic laryngitis—an element producing those phenomena which render it a distinct disease from simple laryngitis. I refer to spasm of the laryngeal muscles. This element pertains to the nervous system, so that spasmodic laryngitis is allied both to the neuroses and to the inflammations.

DIAGNOSIS.—The disease for which spasmodic laryngitis is most frequently mistaken, is pseudo-membranous croup. The friends, indeed, usually make this mistake in forming their opinion of the case before the physician arrives; and there can be no doubt that many of the cases which physicians have published in medical journals as true croup, were examples of this affection. The points of differential diagnosis are the following: True croup begins with symptoms which, at first, are slight, as scarcely to arrest attention, but which gradually increase in intensity. The cough becomes more harsh, and the respiration more difficult, by degrees. This increase in the gravity of the symptoms occurs by day as well as by night. On the other hand, false croup, though preceded by symptoms of coryza, or catarrh, begins abruptly. The symptoms have from the first their maximum intensity, and the time at which it commences is the night. Again, the cough in spasmodic laryngitis possesses a loud, sonorous character; while in true croup, it is harsh or rough from the presence of the membrane, and having, therefore, less fulness. The voice in spasmodic laryngitis may be hoarse, but it is not lost, or is lost only for a short time. It afterwards becomes natural, or is slightly hoarse. On the other hand, in true croup, the voice, from being natural at first, is gradually extinguished. In fatal cases it soon becomes whispering, and continues such till the close of life; in those that recover, the voice remains hoarse for several days. These differences are

important, and, if fully appreciated, are in most instances sufficient to establish the diagnosis. Besides, in a large proportion of cases of true croup, portions of the pseudo-membrane may be discovered on inspecting the fauces, and the faucial surface is deeply injected, while in spasmodic laryngitis there is, with rare exceptions, no false membrane upon the surface of the fauces, and but a moderate amount of congestion.

Laryngismus stridulus, or internal convulsions, must not be confounded with this disease. It is not inflammatory, but purely spasmodic, suddenly commencing and abating—identical, it is believed, in character with tonic convulsions of the external muscles, but affecting the internal muscles of respiration. This disease has already been fully described.

PROGNOSIS.—Little need be added to what has already been stated as regards the prognosis. While a favorable opinion in reference to the result may ordinarily be expressed, the physician should not forget the fact that death may occur. Symptoms indicating an unfavorable termination are: great and continued dyspnea, not diminished by the proper remedial measures; stridulous expiration, as well as inspiration; lividity of the prolabes and fingers; pallor, and coldness of surface; pulse progressively more frequent and feeble. Convulsions and coma may also occur near the close of life.

TREATMENT.—The indications of treatment are twofold: first, to relieve the spasmodic action of the laryngeal muscles; secondly, to cure the laryngitis. To meet the first indication, a warm bath of the temperature of about 100° should be employed as soon as possible after the commencement of the attack. The patient should be kept in it ten or fifteen minutes, in order to obtain its full relaxing effect. In mild cases a warm foot-bath may be sufficient. A second means is the use of an emetic, which should be simultaneous with the bath. To children under the age of three years, syrup of ipecacuanha should be given, in doses of one teaspoonful, repeated in twenty minutes, till vomiting occurs; or alum and syrup of ipecacuanha, two drachms of the former to one ounce of the latter, may be given in the same dose. The alum and the syrup produce more prompt emesis than the syrup alone. Children over the age of three years, unless of feeble constitutions, are best treated by syrup scillæ composuit given in teaspoonful doses, or a mixture of this with syrup of ipecacuanha.

It is not often necessary to give more than three or four doses, and sometimes one or two are sufficient to produce vomiting.

In most cases, by the use of the warm bath and the emetic, the symptoms are rendered milder, and convalescence soon commences.

In the *American Journal of Medical Sciences*, April, 1847, Dr. R. B. Livingston reports a case of laryngitis treated by Squibb's ether. It is stated that portions of pseudo-membrane, from one-eighth to three-fourths of an inch in length, were expectorated; but the symptoms certainly indicated a spasmodic element as decided as in spasmodic croup, and the benefit from the ether was apparently due to the relaxation of the laryngeal muscles which it produced. The treatment of the patient, who was two years old, was commenced by the administration by the mouth of half a teaspoonful of the ether, and followed by its inhalation. "In precisely eight minutes from the time the patient commenced the inhalation, the abnormal muscular exertion ceased; a general relaxation took place; the pulse (which had numbered 150) fell to 100." Ether, judiciously employed, will probably prove to be a useful remedial agent in spasmodic forms of laryngitis, whether or not it has any effect on pseudo-membranous formations. The same may be said of chloroform. A large majority of cases, however, recover speedily without its employment, by the other measures recommended.

To fulfil the second indication, namely, the cure of the inflammation, as well as to control the spasm of the laryngeal muscles, bloodletting has sometimes been resorted to. It is, however, so seldom required that it may be almost discarded as a part of the treatment. In those of full habit, with strong pulse, if the measures already recommended should not give relief, one or two leeches might be advantageously applied to the top of the sternum; but, except in such cases, local bloodletting, and much less general, should not be resorted to.

Attention should always be given to the state of the bowels in spasmodic laryngitis. If they are not well open, a purgative should be administered. For those that are robust, and with considerable febrile movement, the saline cathartics are ordinarily preferable, as Rochelle salts, or a purgative dose of calomel may be administered. The cathartic should not be prescribed till the nausea from the emetic has subsided. By its derivative effect, it

tends to diminish the laryngitis, and, in severe cases, it may obviate the need of depletion by leeches.

Inhalation of the vapor of hot water, and the application of a sinapism over the neck and upper part of the sternum, followed by an emollient position, are useful adjuvants to the treatment.

When the spasmodic element in the disease is relieved, the case becomes one of simple laryngitis, and the general plan of treatment recommended for that disease is proper for this. Small doses of *specaculum*, or of one of the antimonial preparations, as the compound syrup of squills, not sufficient to cause nausea, should now be given at regular intervals. I have, sometimes, added to the expectorant, one drop of tincture of *veratrum viride*, for robust children over the age of three or four years, having a full and rapid pulse, flushed face, and other evidences of active febrile movement. Its effect should be watched, and it should be discontinued when its sedative influence on the circulation begins to be apparent. It should not be given in the spasmodic laryngitis which occurs in the commencement of measles.

If, however, there is not a speedy termination of the disease by recovery, or, more rarely, by death, there is nearly always tracheo-bronchitis, or a more serious affection, coexisting with the laryngitis, or following it; therefore, depressing measures should not be long continued. Expectorants of a stimulating character, as carbonate of ammonia, or syrup of senega, are required in the course of a few days, and in young and feeble children, they should be given at an early period.

The mode of treatment recommended above, is appropriate for that large class in whom the inflammatory element predominates. In a smaller number of cases, the nervous element predominates over the inflammatory, and the treatment should be in some respects different. Such children are usually pallid and of spare habit, having, indeed, the nervous temperament. They are liable to attacks of this disease, though generally of a mild form, on slight exposure to cold, and with a very moderate amount of inflammation. The treatment in these cases should be directed more to the nervous system. My plan has been in the treatment of such cases, after perhaps the use of a mild emetic, to give quinine, one grain three or four times daily, to a child from three to five years old, prescribing at the same time a simple expectorant, as syrup of squills, and a mildly irritating application to the

throat. The symptoms in these cases are not severe, and active measures are not required, though the peculiar cough continues longer than in the more inflammatory forms of the disease.

The patient with spasmodic laryngitis, should be kept in a warm room during the paroxysms, and should inhale an atmosphere loaded with moisture.

Trousseau recommends a mode of treatment of spasmodic laryngitis, which was first suggested by Graves, of Dublin. It consists in the application underneath the chin, so as to cover the larynx, of a sponge soaked in water as hot as can be borne; in ten or fifteen minutes it is repeated. This reddens the skin, producing revulsion from the larynx. The hoarseness, dyspnoea, and cough diminish with this treatment, and some recover without other measures.

Guenant, and others, speak of the importance of prophylactic management of children who are liable to this disease. Attention should be given to the dress, so that there may be sufficient protection from changes of temperature, and there should be an equable temperature of the apartments in which they reside. Children of a decidedly nervous temperament, in whom the slightest laryngitis is apt to be spasmodic, require additional prophylactic measures. They are pallid, and in a more or less cachectic state. Such children are benefited by chalybeate and vegetable tonics, and by exercise in suitable weather in the open air.

CHAPTER III.

PSEUDO-MEMBRANOUS LARYNGITIS.

THE term pseudo-membranous laryngitis, or true croup, is applied to a common and fatal disease, the essential anatomical character of which is inflammation of the mucous membrane of the larynx, with fibrinous exudation. It occurs most frequently between the ages of two and seven years. It is very rare in adult life, and also under the age of six months.

CAUSES.—There is greater liability to this disease in some

children than in others. An occasional hereditary predisposition must be recognized. The common exciting cause is exposure to cold. Those children, especially, are liable to croup, who live in heated apartments, and are taken into the open air without proper covering, and those who a part of the time are warmly and a part of the time thinly clothed, especially as regards the covering of the neck. This disease is common among the poor of New York who live in close rooms, overheated through the day and cool at night. Another less common cause, is the inhalation of irritating vapors, or swallowing irritating or corrosive liquors. I have known a child to die from swallowing acetic acid, and another from scalding water, both having the dyspnoea, and cough of true croup.

This disease is ordinarily primary, but occasionally it is secondary. The secondary form is not unusual in the declining period of measles, and it is an occasional complication of scarlet fever. The pseudo-membranous laryngitis, common in diphtheria, is really a form of secondary croup. It does not differ in any appreciable way as regards its anatomical characters from that disease. Croup is most common in the winter months, and in times of changeable weather. It is said, also, that it sometimes occurs as an epidemic, but it is a question whether the supposed epidemics may not have been diphtheritis.

ANATOMICAL CHARACTERS.—The inflammatory action in this disease affects not only the mucous membrane, but, in a certain proportion of cases, extends to the submucous cellular tissue, causing infiltration or oedema. The mucous membrane itself undergoes similar alteration to that in simple or spasmodic laryngitis, consisting of thickening, and injection, proliferation, and rapid desquamation of its epithelial cells, and an abundant production of mucus. Sometimes the redness is found only in patches at the autopsy; in other cases it extends over the whole surface of the larynx, while, occasionally, it has disappeared so that the laryngeal mucous membrane, though thickened and softened, presents nearly its normal color. In all except the mildest cases the inflammation extends farther than the larynx. It is accompanied by more or less pharyngitis and tracheo-bronchitis.

The distinguishing feature of this disease remains to be described. It is the exudation of fibrin, and the formation of a

pseudo-membrane upon the surface of the larynx, like that occurring upon serous surfaces. This inflammatory product varies greatly in amount in different cases. It may occur only in points, or small patches which are generally found in the vicinity of the vocal cords, while in other cases it extends a continuous and thick membrane from the epiglottis into the bronchial tubes, and there is every gradation between these two extremes. The exuded lymph entering the orifices of the muciparous follicles, and the minute depressions upon the mucous surface, in its diffused state, soon becomes firm and closely adherent, so as not to be detached by efforts of coughing or vomiting, except in small portions.

As the inflammation commonly extends beyond the larynx, so the pseudo-membrane in a large proportion of cases, is formed not only upon the laryngeal, but also upon the contiguous surfaces. In thirty-three cases of true croup, comprised in the statistics of Dr. Ware, of Boston, pseudo-membranous pharyngitis was also present in all but one; and in nineteen cases observed by Dr. Meigs, of Philadelphia, in all but three. The formation of a pseudo-membrane in the trachea in connection with that in the larynx is also common, and in the bronchial tubes, not infrequent. M. Guersant has, so far as I am aware, collected the largest number of records relating to the extent of the pseudo-membrane in true croup. In an aggregate of 120 cases it was confined to the larynx and trachea in 78, or about two-thirds, while in the remainder, namely, 42, it extended into the bronchial tubes.

In those whose systems are robust, the false membrane is usually firmer, in consequence of greater fibrillation, than in those whose systems are reduced. In a state of decided cachexia, it is sometimes friable and easily detached, consisting largely of plastic nuclei with epithelial and pus cells. If the case continues from four to six days, it begins to soften from commencing decomposition, the minute fibres which attach it to the mucous membrane give way, and, in favorable cases, by the effort of coughing or vomiting it is thrown off. Separation is aided by mucus-pus, which collects underneath. In fatal cases the false membrane, if detached by the efforts of the child, is rapidly reproduced, so that in twelve to eighteen hours the dyspnoea returns. Pneumonia is not infrequent as an accompaniment of this disease. In extreme cases in which there is great obstruction to the entrance to the lungs these

coryza are imperfectly inflated. In this state the blood is imperfectly oxygenated.

SYMPTOMS.—In some cases, pseudo-membranous, like simple laryngitis, is preceded by more or less coryza and inflammation of the fauces; in other cases, the laryngitis is present from the first. The commencement of croup is indicated not only by fever, diminished appetite, thirst, and such symptoms as accompany all acute inflammations, but by certain other symptoms which serve to distinguish this from all other diseases.

The cough is one of the earliest symptoms which distinguish true croup from other laryngeal inflammations. It is hoarse or harsh; its character in some cases is better expressed by the term *dry* or *suppressed*. It differs from the cough of spasmodic laryngitis, which is less hoarse and more sonorous. It is much more frequent in some cases than in others: in many patients towards the close of life, it nearly or quite ceases. Hoarseness of the voice is also one of the first and most constant symptoms, and it continues throughout. Towards the close of life, the voice is usually lost, and the child expresses its thoughts in an indistinct whisper.

The amount of expectoration varies considerably in different patients, according to the presence or absence of bronchial inflammation. If the inflammation extends so low as the upper part of the trachea, the sputum is scanty during the whole course of the disease. In ordinary cases it is scanty at first, then more abundant, and again more scanty if the case is fatal. The scantiness of the sputum towards the close of life is due not entirely to exhaustion of the patient, but in part to obstruction in the larynx above the *mens* and *pux*. By vomiting a much larger quantity is expectorated than by the cough. Frequently small portions of pseudo-membrane are expectorated with the *mens* and *pux*, and occasionally larger masses, complete moulds, indeed, of the larynx, trachea, or even of the bronchial tubes.

The respiration is accelerated, but not so much as in pneumonia or capillary bronchitis. In the advanced stage it commonly becomes slower than at first. As the obstruction in the larynx increases, the respiration assumes more and more the character which has been designated *abdominal*; the *infra-mammary* region is depressed in each inspiratory act, while the larynx approaches the sternum, and the *alae nasi* are dilated. Patients sometimes have painful attacks of dyspnoea, due to detachment of an edge

of the pseudo-membrane, and its doubling upon itself. In the paroxysm, the sufferer throws himself from side to side in the bed, or reaches his arms to his mother or nurse for relief; his eyes are wild, features anxious, and in severe paroxysms, fingers and prelochia livid. In the interval there is comparative quietude, though the respiration is constantly embarrassed.

The frequency of the pulse varies according to the extent of the inflammation and the stage of the disease. In the commencement of primary croup, it ordinarily varies from about one hundred and ten to one hundred and twenty beats per minute. In the course of the disease, it becomes more frequent, and towards the close of life feeble.

Now and then a patient presents a decided remission in symptoms, due to detachment of the fibrinous product, and the friends are apt to think that the danger is passed. Unfortunately the lull in symptoms is in most cases deceitful, as the cause of the dyspnoea is rapidly reproduced. I once attended a case in which there had been such dyspnoea, that an unfavorable prognosis was given. An almost complete intermission, however, occurred in the symptoms, with the exception of the febrile movement, so that a physician who visited the patient at this time, diagnosed an essential fever. In a few hours the pseudo-membrane being reproduced, the symptoms returned with greater violence than ever, and the child died. So complete an intermission seldom occurs in a fatal case; and in most patients, during the times of temporary improvement, there is still such dyspnoea, with the characteristic cough, that the nature of the disease is apparent.

If the stethoscope is applied over the larynx in true croup, the loud expiratory as well as inspiratory sound is heard, as the air passes by the obstruction. This sound is often transmitted to every part of the chest, so as to obscure the râles which may be produced there. Auscultation over the chest reveals either the vesicular murmur, perhaps somewhat diminished in intensity, or more frequently the sonorous and afterwards moist râles, due to coexisting bronchitis. In a limited number of cases, dulness on percussion is observed at some part of the chest, with bronchial respiration, indicating pneumonia. Recovery from croup is in most patients gradual; the voice becomes less hoarse, the cough looser, and the dyspnoea ceases by degrees. The structural changes which have occurred in the mucous membrane of the

larynx, do not disappear till several days after the last pseudo-membrane is detached.

Fatal cases may terminate in two or three days, but their ordinary duration is from five to fourteen days. Death may result directly from the thickness and firmness of the pseudo-membrane, which obstructs the entrance of air. Sudden death in a paroxysm of dyspnoea may occur from the detachment of one end of the pseudo-membrane, and its folding upon itself. In many patients, death is not due so much to obstruction to the entrance of air from the presence of the pseudo-membrane, as to the mucus and pus which collect in the trachea and bronchial tubes, and which are not expectorated on account of the presence of the pseudo-membrane, and the feeble expiratory efforts of the child. In a case which was examined after death in the Nursery and Child's Hospital of this city, the fibrous formation was in appearance not sufficient to produce a fatal result, but the air passages below it were nearly filled with mucopurulent matter.

PATHOLOGICAL CHARACTER.—This disease is then essentially a laryngitis, presenting the anatomical character of the simple inflammation of the organ, but with a superadded element. The chief additional feature is the fibrous exudation on the surface of the laryngeal mucous membrane. The coexistence of pharyngitis, tracheitis, and bronchitis, with or without the pseudo-membrane, is common. The chief danger in this disease arises from the presence of the pseudo-membrane, and consequent impediment to respiration. The obstacle to the entrance of air is increased by the inflammatory swelling of the laryngeal mucous membrane, especially that covering the vocal cords and by submucous oedema or infiltration.

There is a neuropathic element in many cases, though not as conspicuous or important as in spasmodic laryngitis. It is the common belief that in some cases, if not generally, there is more or less spasmodic contraction of the vocal cords, induced by the inflammation, and hence the easier breathing in sleep and also in the state of general muscular relaxation which immediately precedes the death of the patient, when it occurs in the ordinary manner. Professor Jacobi (*Amer. Jour. of Med.*, etc., N. Y., May, 1868) believes that the neuropathic state is muscular paralysis, instead of spasmodic contraction. In his opinion this paralysis

"is secondary. It depends on the oedematous swelling of the posterior crico-arytenoid muscles following the oedema of the mucous membrane of the crico-arytenoid folds." Imperfect oxygenation of the blood is the important consecutive element in the pathology of this disease.

DIAGNOSIS.—The diagnosis of true croup is ordinarily easy. There is only one disease for which it is liable to be mistaken, namely, spasmodic laryngitis. More frequently spasmodic laryngitis is mistaken for it. The differences which will aid in differential diagnosis are the following: commencement abrupt, and at night in one, gradual in the other; presence in one, absence in the other of a pseudo-membrane upon the surface of the fauces; fragments of fibrin in the sputum in one, character of the cough; course of the disease, growing gradually worse in one, in the other with few exceptions rapidly improving. Trouessart speaks of the liability to error of diagnosis in those cases in which spasmodic laryngitis is associated with pseudo-membranous pharyngitis. Few physicians hesitate to designate as true croup those cases in which there is a croupal cough in connection with false membrane upon the surface of the fauces, and yet the laryngitis under such circumstances may be merely spasmodic. This coexistence of pseudo-membranous pharyngeal, and of spasmodic laryngeal inflammation is, however, probably rare; its occasional occurrence should be born in mind.

True croup is readily distinguished from laryngismus stridulus, or infantile convulsions. Laryngismus stridulus is a purely nervous affection: it occurs suddenly, causing great dyspnoea, or momentary suspension of respiration without the fever, and without the hoarse voice and cough of croup. When muscular relaxation occurs the attack ceases. The difference between the two diseases is therefore obvious.

PROGNOSIS.—The great mortality from true croup is universally known, and those physicians who report a large number of favorable cases have probably mistaken spasmodic croup for this disease. According to the statistics of Dr. Ware, nineteen out of twenty die. With judicious treatment commenced at an early period, the mortality is probably less, though still great. Increase of dyspnoea, the voice and cough becoming more hoarse, and the pulse more accelerated, indicate a fatal form of the disease. Attention has already been called to temporary improvements

which are apt to occur in croup, and lead to an error in prognosis. However, improvement continuing more than twelve hours is evidence of the decline of the disease.

The near approach of death is shown by lividity with great restlessness, or by pallor, and comatose. If the patient recovers from croup, there often remains more or less bronchitis or broncho-pneumonia, which requires treatment, and the laryngitis, when its pseudo-membranous character is lost, persists for a time, causing more or less hoarseness and acceleration of pulse.

TREATMENT.—The importance of early treatment in this disease has been sufficiently alluded to. If it has continued two or three days when first recognized the chance of recovery is greatly diminished. As the danger in true croup arises from the presence of the pseudo-membrane, the indication is to prevent its formation, so far as possible, and to aid in its removal when formed.

Emetics have been and are still much employed in the treatment of this disease. Properly employed, they sometimes produce a good effect, but much harm has been done by their injudicious administration. As a rule, the depressing emetics should not be given except at the commencement of the disease, not later, indeed, than the second day, and not given at all if the patient is feeble or cachectic, or if the croup is secondary, as when it occurs in connection with measles or diphtheria. I have known death occur almost immediately after the administration of an antimonial emetic in the pseudo-membranous laryngitis accompanying diphtheria, when there was no urgent dyspnoea.

I have no doubt of the beneficial effect of emetic treatment in the commencement of primary croup. It promotes the secretion of mucus, and is attended by a more or less abundant vomiting of this substance. It removes from the larynx by the forced expiration which it causes, any albuminous or fibrinous substances which are still in their diffused state, and which, by remaining, would become pseudo-membrane. The depressing effect of emesis is the cause of error, and at the period of the disease mentioned, I consider beneficial rather than injurious. It diminishes, by its sedative effect on the heart's action, the afflux of blood to the larynx, and consequently the intensity of the laryngitis. If the child is robust, and above the age of three years, the best emetic is the tartrate of antimony and potassa, and an eligible mode of administering this agent is in the compound syrup of squills.

From half a teaspoonful to one teaspoonful may be given, and if no emesis is produced, repeated in twenty to thirty minutes. For children under the age of three years ipecacuanha is preferable. The syrup may be administered, and it is proper sometimes for strong and robust children to combine it with an antimonial preparation.

The loss of blood is not required in the treatment of croup. The stronger cardiac sedatives, as aconite and veratrum viride, may occasionally be advantageously employed in the first and second days of primary croup. They should only be administered to those that are robust. They should not be employed after the pseudo-membrane is fully formed, nor should they be in cases of secondary croup. I have employed the tincture of veratrum viride in doses of half a drop to one drop every three or four hours for those over the age of three years.

Unfortunately, the measures which have been described and which must be considered preliminary, have but a partial effect in arresting the disease. It is probable that they do sometimes diminish the amount of fibrinous exudation if early employed, and may even prevent it, so that the disease remains a simple laryngitis, but in the majority of cases, the pseudo-membrane becomes fully formed and continues to increase. The profession have long been looking for a remedy which, taken internally, might, by its effect on or through the blood, prevent the fibrinous exudation, and also for a remedy which, employed topically, might liquefy and remove it. Until a recent period, calomel was commonly prescribed by physicians as the most reliable remedy in croup, in the belief that it diminished the "plasticity of the blood." It has had its day, and is falling into disuse in the treatment of this, as well as the other inflammations. It is uncertain whether it does exert any material controlling influence upon the progress of croup. As a substitute for calomel, physicians of this city are using more and more a mixture of chlorate of potassa or of soda and muriate of ammonia given frequently. The chlorate has a solvent effect, though feeble, on fibrinous exudations, and as when taken into the system it is known to be eliminated in most of the secretions and excretions, it is not improbable that it escapes also from the surface of the larynx in the mucus, and in this manner comes in contact with the pseudo-membrane. It is known that the chlorates in frequent doses sometimes cause salivation, and

this effect has been observed in this city in cases in which they have been employed for croup. To what extent muriate of ammonia affects the fibrinous formation, or whether it exerts any effect upon it, is uncertain.

Cases in which there is marked and protracted dyspnea and croupal cough, do now and then recover with the use of chlorides of potassa or soda and muriate of ammonia, so many, indeed, that I know of no physician, who after employing these agents, has returned to the calomel treatment. Still, severe cases of true croup are ordinarily fatal with any kind of medication, and it is not to be forgotten that some of those who have recovered by the use of the ammonia and potash, have probably had the spasmodic form of laryngitis, even when the dyspnea continued for some days. The following formula for these medicines is for a child from three to five years old:—

R.—Potas. chlorat. ℥j;
Ammon. muriat. ℥ij;
Syr. simplic. ℥ij;
Aq. ℥ij.
Misc.

One teaspoonful every twenty minutes to a half hour, or in cases not severe, every two hours. This should be continued regularly night and day, until the cough becomes looser, or until it is evident, if the case is unfavorable, that it can be of no service.

A very important part of the treatment of pseudo-membranous laryngitis is the inhalation of steam. Some of our most experienced physicians believe this to be more useful than all other measures combined. In one of the most severe cases which I have met, which terminated favorably, the room was so filled with steam that water hung in drops from the ceiling. The atmosphere which the child breathes should be constantly loaded with moisture, without, however, that degree of heat which would add materially to the discomfort of the patient or attendants. The moist air coming in contact with the inflamed surface promotes expectoration and renders the cough looser. Steam may be readily produced by placing heated irons or bricks in a shallow pan or pail containing a little water, or by pouring water upon a heated surface. In order to avoid heating the entire room and to concentrate the vapor, the nurse may sit with the

child under a frame covered with a blanket, and the steam be produced underneath. An apparatus for generating steam is constructed in this city (by Roschetti, 92 Fulton Street). Its construction is simple; it has the form of a small pail, and is, therefore, readily portable. Steam is produced by a spirit lamp placed underneath the pail, and is conducted by a tube; this apparatus produces but moderate elevation of temperature in the apartment. The serious objection to it is that it does not generate the necessary amount of steam. It may be employed in conjunction with other measures.

A temperature of 75° or 80° , if the atmosphere is loaded with moisture, is more readily tolerated than a lower temperature with a dry atmosphere, and a temperature at least as high as 75° is required, or too much of the vapor is deposited. Of late, the inhalation of the spray of lime-water has been recommended in the belief that it exerts a solvent effect upon the fibrin, since a fibrinous coagulum gradually dissolves if macerated in lime-water. The atomizer has been employed in order to produce the spray, but difficulty attends its use for children. It has been still more recently recommended to add to the water which is employed for the purpose of producing steam, one or two lumps of quick-lime and allowing them to slake. The vapor by this means becomes pretty strongly impregnated with particles of lime. I have made use of this mode of treatment, but not sufficiently to speak advisedly in reference to it. This last mode of employing lime may obviate the principal objection which has been raised against the use of steam in the treatment of croup, namely, that it necessitates confining the air, which soon becomes loaded with carbonic acid, since slaked lime when moistened, rapidly absorbs this gas. The employment of lime by inhalation in this disease certainly merits farther trial.

It has already been stated that depressing emetics should not be employed after the first or second day. A period, however, arrives in most cases when another class of emetics are required. They are required when the dyspnea is urgent as a means of removing from the air passages the collection of mucus and pus and portions of false membrane which may be detached. These emetics should now be prescribed which operate promptly with the least depression. Sulphate of copper is one of the best, if not the best, emetic for this stage of croup, and it is usually employed by physicians. A child of five years may take one

grain dissolved in a little water, and the dose be repeated if necessary in fifteen to twenty minutes. Sulphate of zinc or turpeth mineral may be used in place of the copper. Dr. J. P. Meigs, of Philadelphia, prefers pulverized alum given in tea-spoonful doses, but it is an unpleasant medicine, and I am not aware that it possesses any advantages over the sulphate of copper. Whatever emetic is employed, its operation may be promoted by draughts of warm water.

It is to be recollected in the treatment of croup that the pseudo-membrane, by commencing decomposition, and by the pus and mucus which collect underneath, is more easily detached after a few days, if the patient lives, than at first. Therefore, it should be an object of the practitioner to sustain the vital powers in order that the cough may have sufficient force to separate this substance, as soon as its fibres of attachment begin to loosen. A patient with croup rarely takes solid food, but he should be allowed beef-tea, milk and farinaceous drinks at short intervals. If there are signs of exhaustion, alcoholic stimulants are proper. Fresh air should also be allowed so far as is compatible with the inhalation of steam.

While these general measures are employed local treatment should not be neglected. The profession are not agreed as to the treatment either external or internal of the throat. As to external treatment, some recommend poultices, others cold applications, and others still irritants. Professor Penhale, of this city, in a series of papers on the pathology of croup, published in the *American Medical Monthly*, 1854, says of cold applied externally: "We consider this of the greatest value and importance. If cold applications are efficacious in all cases of external inflammation, they are scarcely less so here where the inflamed surface is so nearly superficial. Cold must, however, be continuously applied to produce the desired effect. Applied at intervals, indeed, it rather provokes than retards the inflammatory process; since during the intervals the temperature rises above the normal standard in consequence of the reaction of the chill on the surface. Cold water may be constantly dropped from a sponge upon a compress laid over the throat of the child; and the latter should be of only one or two thicknesses of linen, that evaporation may go on as rapidly as possible." A mode of treatment directly opposite to this is also recommended, namely, the constant use a moist, warm poultice.

or of a cloth wrung out of hot water, and covered by oil silk. It is recommended at the same time to irritate the skin over the larynx and upper part of the sternum by mustard, tincture of iodine, or other means.

In a large proportion of cases the application of cold to the neck is in my opinion preferable to that of warmth. It does not interfere with the treatment by steam, or may not, but I suggest as an improvement on Professor Pease's mode of employing it, which must be difficult on account of the restlessness of the child, that small pieces of ice be used, properly surrounded by muslin or flannel and secured upon the throat, and external to this oil silk be placed to prevent dripping.

Whether this application is or is not useful can be ascertained by observing whether it adds to the patient's comfort. If it increase the restlessness, or cause frequent attempts to remove it, it might better be discontinued. Under such circumstances moist and warm applications, with a moderate degree of counter-irritation, are preferable. Cold to the neck is especially serviceable if the child is robust, with flushed cheeks and full and rapid pulse, and has advanced beyond the third year. In secondary croup, or croup occurring in feeble states of system, or presenting a sub-acute character, poultices, or fomentations to the neck with moderate irritation will often give most relief.

Topical treatment of the fauces and larynx has long been recommended in croup, and the agent which has been most frequently applied is nitrate of silver in solutions varying in strength from ten to forty grains to the ounce. It is applied once, twice, or several times daily. Nitrate of silver does not dissolve fibinous exudations, but it contracts them, and probably by the contraction aids in their detachment. A part of the good effect which is believed to result from the use of nitrate of silver may be due to the mechanical effect of the probang with which it is applied.

Great difficulty, however, attends the application of the probang to the larynx of the child, on account of his struggles and resistance, and it may well be doubted whether the most skillful operators usually succeed in doing it. But if the instrument is pressed only against the aperture of the glottis, some of the liquid trickles from the sponge into the larynx, as is indicated by the severe coughing which it produces. Of late years three other

substances have been used for topical treatment of the throat, which appear to be more effectual in removing the pseudo-membrane and controlling the inflammation. One is liquor ferri subsulphatis; the other carbolic acid, and the third bromine. The liquor ferri subsulphatis is best employed with glycerine in the proportion of one part to four.

R.—Liq. ferri subsulphatis ℥j;
Glycerine ℥ss;
Mise.

Carbolic acid, in its crystalline or undiluted state, is an active caustic, with a tendency to spread. It should be used considerably diluted with water.

R.—Acid. carbolic, ℥ss;
Aque ℥vi;
Mise.

Bromine has only recently been employed for topical treatment of pseudo-membranous inflammations. It is used in conjunction with bromide of potassium.

R.—Bromidi ℥ij;
Potas. bromid. gr. xlv;
Aque ℥j;
Mise.

This is called the bromine solution, but it must be considerably diluted for use. Twenty-four to forty drops should be added to an ounce of water for application to the fauces or larynx. There are physicians who highly extol each of these three agents in the treatment of croup as well as diphtheria. They are probably all useful, though I cannot speak from personal observation in reference to the effect of bromine. They should be applied in the same manner as nitrate of silver, to which, in my opinion, either one is preferable. Of the three agents, the one which I can highly recommend from personal experience for those cases which require this mode of treatment, is the subsulphate of iron. Local treatment, as recommended above, is obviously most useful in those cases in which there is decided inflammation of the faucial surface attended with patches of false membrane, or those cases in which the inflammation is first pharyngeal and becomes laryngeal by extension. In all those cases, therefore, in which the pharyngitis is secondary or slight, it is doubtful whether the

benefit is sufficient to justify the performance of an operation so unpleasant, and indeed painful, as the use of the probang.

Unfortunately, as I have already stated, true croup, whatever the therapeutic treatment, is, in a majority of cases, a progressive disease. The dyspnoea increases, and the cough and voice become more and more hoarse and feeble. The pulse, becoming more frequent and feeble, indicates the need of the most nutritious food, as the animal broths, and of alcoholic stimulants. The danger is, however, from the dyspnoea rather than ashenia. Medicine has failed to check the disease, and shall now the expedients of surgery be tried—shall tracheotomy be performed?

The published statistics relating to tracheotomy in croup are to a considerable extent unsatisfactory, since we are not informed as regards most of them at what stage of the disease the operation was performed, and what were the evidences of a fibrinous exudation. The most valuable and reliable statistics bearing upon this subject, so far as I am aware, are those published by Prof. Jacobs, of this city, in the *American Journal of Obstetrics, &c.*, for May, 1865, and containing the results of the cases which were operated on by himself and Drs. Krackowizer and Voss. These gentlemen are known to the profession of New York, as careful and judicious practitioners, not likely to operate where there was possibility of success by therapeutic measures, and not likely to mistake simple or spasmodic laryngitis for true croup. I have tabulated the statistics of their operations:—

Age	Number	Recovered	Died
Under 2 years	8	1	7
From 2 to 5 years	28	5	24
" 2 to 4 "	26	4	22
" 4 to 5 "	34	11	23
" 5 to 6 "	9	2	7
" 6 to 7 "	1	1	0
" 7 to 8 "	2	0	2
" 10 "	1	0	1
Not given	53	15	48
	164	29	135

Time of death after operation	Number of cases	Time of death after operation	Number of cases
Within 24 hours	19	On 5th day	9
On 2d day	7	" 6th "	4
" 3d "	16	" 7th "	3
" 4th "	12	" 8th "	1
		From 10th to 31st day	3
Total			78

The following were the causes of death, as given in the records of 73 cases:—

In operation	1	Pneumonia	8
Asphyxia from the late operation	8	Brochio-pneumo. & peftra. gangrenas	1
Asphyxia	3	Pulmonary oedema	1
Anaemia and exhaustion	4	Pseudo-membranous bronchitis	18
Diphtheria	8	Tuberculosis	1
Brachitis	8	Convulsions	1
Brachio-pneumonia	15	Euphysema	1

Total 73

The following table gives the result of tracheotomy in one hundred cases. It is prepared from the statistics of Gütlerbach, lately published:—

Age.	Result.
Under 1 year	1 case fatal.
Between 1 and 2 years	" "
" 2 and 3 "	55 per cent. recovered.
" 3 and 4 "	80 " "
" 4 and 5 "	38 1/2 " "
" 5 and 6 "	44 " "
" 6 and 7 "	141 " "
" 8 and 9 "	25 " "

From conversations, which I have had with surgeons of New York, I am persuaded that the above tables present a more favorable result than would be furnished by the general surgical practice of this city. Most New York surgeons, however, seem to shun the operation and regard it with ill-favor. Did they operate as frequently as those, whose names I have mentioned, possibly the result would be better.

The facts in reference to tracheotomy in croup are the following: The majority of those operated on do not recover, but some live who without the operation would die. The operation is now more successfully performed than formerly, as the conditions of successful operation are better understood. Those who have operated several times, confess that their last cases did better than their first. Trousen's experience was striking and instructive in this respect. No one, probably, ever performed this operation for croup more times than he, and, from constantly greater success, he became more and more an advocate of the operation. Tracheotomy, if properly performed, does not in any case shorten life, but it frequently prolongs it several days. It diminishes greatly the dyspnoea and renders death easy.

The objections to the operation are partly of a moral nature. The parents, already in the extreme of grief on account of the suffering and probably death of the child, consent with reluctance to an operation which promises not cure, but a prolongation of life. Common sympathy with the child and regard for the emotions of the parents should certainly have an influence in deciding for or against the operation. The first case of tracheotomy which I witnessed was such as, if common, would condemn this operative measure entirely. No anæsthetic was given, and in the midst of the struggles of the child, large veins were severed from which an abundant hæmorrhage occurred. The trachea was opened, but this was no sooner done than death occurred, partly from the loss of blood; partly from its entrance into the bronchial tubes. Such cases are, however, quite exceptional. Death rarely occurs during the operation, unless the patient is already moribund, and the possibility of such a result should have little weight in our decision for or against the operation.

No one will deny, in the light of statistics, that tracheotomy is, in certain cases, proper, and that a physician at times would be culpable if he did not strongly urge its performance. There are certain supposed contraindications. One is age less than two years. It is true that those under the age of two years are less likely to recover after the operation than those above that age, still, tracheotomy has now and then saved the lives of the youngest infants, who have croup. The possibility, therefore, of success justifies the performance of the operation, however young the infant, when the only alternative is death. In the foregoing statistics it is seen that one of eight recovered who were under the age of two years.

The presence of capillary bronchitis or pneumonia does not positively contraindicate tracheotomy, though it diminishes greatly the chances of a favorable issue. Nor is tracheotomy forbidden by the extension of the false membrane into the bronchial tubes, since it diminishes the amount of obstruction along which the air passes in order to reach the lungs, and the mucus as well as pseudo-membrane, lying below the point of operation, may be expectorated through the aperture. A decidedly æsthenic state, as after measles or scarlet fever, indicated by feeble pulse and other symptoms of exhaustion, may or may not contrain-

indicate the operation, whether the pseudo-membrane is limited to the larynx and trachea or is more extensive.

The manner of performing tracheotomy and the subsequent treatment pertain to surgery, and are described in surgical works. A skilful surgeon should, indeed, be employed to perform the operation when it is practicable. At what time in the course of the disease tracheotomy should be resorted to is an important practical question. Trousseau at one time recommended it as soon as there were certain evidences of the presence of a pseudo-membrane, but in the latter part of his life he did not operate so early. The correct rule, in my opinion, is not to operate till there are signs that the blood is not sufficiently oxygenated, such as lividity of the prolabia and tips of fingers. When these signs occur it is unsafe to delay long. The arrangements should be previously made that no time be lost.

It is an interesting fact that a large proportion of those who die after tracheotomy die of bronchitis, usually capillary, or of pneumonia developed after the operation. These diseases seem to be partly attributable to the operation, or if previously existing, to be aggravated by it. It is believed that the introduction into the bronchial tubes and the lungs of cool air, of air not warmed by the natural circuit through the nostrils and larynx, may be a cause of these inflammatory complications. Sometimes, also, the canula by pressure increases the inflammation of the surface on which it lies. Therefore, not only does the operation require skill in its performance, but much of its success depends on the subsequent management. After the operation, the temperature of the apartment should be kept constantly at from 85° to 90°, and loaded with moisture. This obviates in part, but only in part, the tendency to bronchitis and pneumonia. Constant attention should be given to the canula to prevent its filling with mucus and pus. Trousseau employed a double canula, which can be readily cleaned by removing the internal cylinder. The nurse, when properly instructed, can remove the canula as often as may be necessary in order to clean it. Mr. Lawrence, of London, and following him, some other surgeons prefer not to use the canula. The edges of the wound are kept apart by a wire which passes around the neck, or a little of the trachea is removed so as to produce a sufficient aperture. The reader is referred for particu-

lars regarding this mode of operating to recent treatises on operative surgery.

After the operation no more medication is required. The patient should be kept quiet and free from excitement. His diet should be mainly liquid, and of the most nourishing character. In a few days, if the symptoms abate, the aperture may from time to time be closed with the finger after the withdrawal of the canula, in order to ascertain if the larynx is free from obstruction. If bronchitis or broncho-pneumonia arise, the oil silk jacket, with counter-irritation to the chest, is required, and stimulating expectorants, as carbonate of ammonia and syrup of omega should be ordered.

CHAPTER IV.

BRONCHITIS.

INFLAMMATION of the bronchial tubes, or bronchitis, is probably the most frequent disease of early life. It is usually associated with more or less inflammation of the mucous membrane of the nostrils, larynx, and trachea. We designate the disease coryza, laryngitis, or bronchitis, according as one or the other inflammation predominates. Sometimes bronchitis occurs with but slight inflammation elsewhere, and often the coryza and laryngitis abate, while the bronchitis is still active.

Bronchitis occurs both as a primary and secondary disease. The secondary form is common in connection with measles, whooping-cough, pneumonia, and pulmonary phthisis, and it is not uncommon in scarlet fever, variola, remittent and continued fevers. Bronchitis is mild or severe, and acute, subacute, or chronic. If the inflammation affects the bronchioles, the bronchitis is called capillary. Bronchitis is usually bilateral, affecting the tubes on the two sides with about equal intensity. The exceptions are when it is dependent on pneumonia or pulmonary phthisis. In these cases it is confined to those tubes, or nearly to those which are surrounded by the tubercular or inflammatory product.

CAUSES.—The causes of secondary bronchitis are obviously the diseases in connection with which it occurs. The cause of primary bronchitis is the same as that of simple acute laryngitis or coryza, namely, sudden change of temperature from warm to cold, exposure to currents of air, the practice of sending children without sufficient clothing from heated rooms into the open air, the throwing off of bedclothes at night, etc. Dentition is also an occasional cause, since some children have attacks which coincide with the eruption of the teeth. The cough of dentition is occasionally purely a nervous affection; but in other instances it is accompanied by more or less mucous secretion, and is evidently dependent on a mild inflammation.

ANATOMICAL CHARACTERS.—In the most common form of bronchitis, the larger bronchial tubes only are affected. They are the seat of the inflammation in most of those cases which are designated "colds" by families, and which are often treated without the aid of the physician. The lining membrane of the bronchial tubes presents the ordinary anatomical characters of mucous inflammations. It is reddened uniformly or in patches, intensely, or in that milder degree known as arborescence, according to the severity of the inflammation.

The secretion of the muciparous follicles is at first arrested, and the surface of the membrane is dry. In the course of a day or two the secretory function is re-established, and the surface is covered with thin and transparent mucus. A day or two later, the secretion becomes thicker, consisting of mucus and pus. Mixed with these substances are epithelial cells, which are exfoliated in abundance from the inflamed surface. At the same time the mucous membrane becomes thickened and more or less softened. If the inflammation is severe, the vessels of the submucous cellular tissue are also injected.

Usually, in about a week in the young child, in from one to two weeks in older children, the inflammation begins to abate. Gradually the inflamed membrane returns to its normal consistence, thickness and vascularity, and with this returns to the healthy state the muco-purulent secretion abates.

In this, which is the simplest form of bronchitis, and most common, there is no ulceration, and rarely any pseudo-membranous formation, if the disease is idiopathic. Pseudo-membranous

bronchitis is not unusual as an accompaniment of pseudo-membranous laryngo-tracheitis.

Were bronchitis limited to the larger bronchial tubes, it would indeed be a simple affection. But, unfortunately, in many children the inflammatory process extends downwards. Commencing in the larger, it gradually invades the smaller tubes in a similar manner to the extension of erysipelas upon the skin. More rarely the inflammation commences simultaneously in the larger and smaller tubes. Now the gravity of bronchitis is proportionate to the degree of its extension downwards. It may stop at any point in its progress, but if it reach the bronchioles, it is one of the most serious affections of early life, that already alluded to, namely, capillary bronchitis.

The mucous membrane of the minute bronchial tubes, those next to the air-cells, is delicate, with but little submucous cellular tissue, and it frequently, at post-mortem examinations, does not present to the eye those distinct inflammatory changes which are observed in tubes of larger diameter. It is sometimes not notably thickened, nor its vascularity much increased, even when there is reason to believe from the symptoms that it was the seat of active phlegmasia. As we pass from these minute tubes to those of larger calibre, the inflammatory lesions become more distinct. The inflammation produces minute and abundant points of redness, and the membrane is evidently thickened; often it is rough or granular.

The minute bronchial tubes are very small, especially under the age of three years, and since in capillary bronchitis a large proportion of them are inflamed, the source of the danger is apparent. It is with difficulty that the patient with capillary bronchitis can, by the effort of coughing, free the tubes from the secretions which are constantly collecting in them. In weakly children, under the age of two years, expectoration is most difficult, and hence the great and increasing dyspnoea with which such patients suffer.

In unfavorable cases of capillary bronchitis, the following changes are apt to occur. The small tubes, usually those in the posterior portion of the lungs, become more and more loaded with mucus and pus, obstructing the entrance of air till, finally, one after another of the lobules ceases to be inflated. As the air passes out of the air-cells of a lobule more readily than it enters

them, partial lobular collapse occurs. Doubtless, also, some of the mucus and pus no longer expectorated is forced backward into the air-cells. Now, a portion of lung from which air is excluded while the circulation continues, becomes congested. If the lungs are examined of a patient who has died at this stage of capillary bronchitis, the anterior portions will be found to present nearly their normal appearance, while the lobular changes which have been described, will be found mainly in the posterior part. Certain of the lobules will be observed depressed below the common level, of a dark red color from passive congestion, firm to the touch, and non-crepitant or feebly crepitant. Sometimes only a few of the lobules have undergone this change of collapse and congestion, but more frequently a considerable number on both sides are affected.

Up to this time there is no pneumonia, but this is the condition of lungs and bronchial tubes which has been designated *leucitho-pneumonia*. This state of lung has also sometimes been called lobular pneumonia. The substance which fills the bronchial tubes is usually mucopurulent, but in exceptional cases, in addition to mucus and pus, there is more or less fibrin. This ordinarily occurs as a delicate film of small extent, observed here and there, and readily detached from the surface underneath. In rare instances, it occurs as a firm and continuous membrane, forming a mould of the tubes, increasing greatly the dyspnoea, and constituting a true bronchial crelop.

If the patient survive the immediate effects of capillary bronchitis, the inflammation of the mucous membrane soon begins to abate. The collapsed and congested lobules, and the terminal portions of the bronchial tubes leading to them, which are obstructed by inflammatory products, do not always return to their normal state as the inflammation declines. They then undergo pathological changes which are interesting, but which are not fully understood. When the function of a portion of lung ceases, as it does when the air is excluded from it, its nuclei and epithelial cells, and perhaps other portions, begin to undergo fatty degeneration. These cells become granular, somewhat enlarged and opaque, and here and there mixed with them are other large cells filled with oil globules. These large cells are the compound granular cells of pathologists, and are produced by complete fatty degeneration of the epithelial cells. They are epithelial cells

which have progressed more rapidly than others in fatty degeneration. They have reached that stage of it which immediately precedes liquefaction. I have often with the microscope observed fragments of the compound granular corpuscles as they were dissolving. These cellular changes uniformly occur in persistent pulmonary congestion and collapse.

If the lobules remain collapsed for a considerable period on account of the feeble inspiratory efforts of the child, and the presence of mucus and pus which obstruct the tubes, they may undergo such change that they are not inflated, even when the tubes become freed from obstruction. If an opportunity is presented of examining the lungs at this time, it will be found difficult, if not impossible, to expand, even by strong insufflation, the lobules which have been for a considerable period collapsed and more or less congested. These lobules have a greater specific gravity than water, and closely resemble lobules which are solidified by inflammation, but when the changes occur which have been detailed above, there is obviously no true pneumonia at first, although there is reason to believe that it may subsequently occur.

Until a recent period it was the belief in the profession that capillary bronchitis may eventuate in pneumonia by extension of inflammation. Of late, since the pathological state described above has been more clearly understood, this belief has been in great measure discarded. In my opinion, however, inflammation does sometimes extend from the minute bronchial tubes into the parenchyma of the lungs in the infant, and pneumonia therefore becomes a result and complication of capillary bronchitis. This subject will be farther treated of in our remarks on pneumonia.

Minute abscesses, usually directly under the pleura, have occasionally been observed at the autopsies of those who have recently had capillary bronchitis, and pathologists are not agreed as to the mode in which they are produced. Some of them, if not all, are evidently connected with the minute bronchial tubes, and the quantity of pus contained in each is not usually more than one or two drops. The most reasonable view of their causation is that they are produced in the terminal tubes where the mucus and pus collect. The pus acts as an irritant and causes inflammation, and the inflammation increases the quantity of pus. The

walls of the tube which is now the seat of an abscess are destroyed by ulceration, and probably, also, some of the contiguous air cells. The little cavity is soon surrounded by a delicate membrane, the same in character, though less thick and firm, with that which constitutes the walls of larger abscesses. The pus presents the usual appearance of this liquid, or it may be tinged by the presence of blood cells, or again it may be thick from partial absorption of the liquor puris so as to resemble softened tubercle.

The abscess is ordinarily located in the centre of a collapsed lobule. Sometimes it approaches the surface of the lung, so as to produce circumscribed pleurisy with adhesions of the costal and visceral pleura. Sometimes on separating the adhesions, and attempting insufflation, the air passes directly through the aperture, so that the lung on that side cannot be inflated unless the aperture is closed. Occasionally pneumo-thorax results from opening of the abscess into the pleural cavity.

Dilatation of the bronchial tubes is an occasional result of bronchitis, especially when severe and protracted. It is usually slight. Emphysema is a common lesion observed in young children, whether death has occurred from disease of the respiratory or some other system. It is observed most frequently in the upper lobes, and oftener in their anterior than posterior portions. The bladders of air are usually small and of irregular shape, as they lie compressed by the lung-tissue. If they are open or near the surface of the lung so as to distend the pleura, they may attain considerable size. I have seen them of the size of a filbert in infants under the age of one year. In exceptional cases there are many of these air bladders situated between the root of the lung and its anterior border, and perceptibly augmenting its volume. It is believed that bronchitis is an occasional cause, or one of the causes of emphysema, particularly when it is attended by great dyspnoea and forcible efforts of inspiration.

SYMPTOMS.—It is evident from the description which has been given of the anatomical characters of bronchitis, that its symptoms vary greatly in severity in different patients. It usually commences with more or less coryza. The symptoms are headache, flushed face, elevation of temperature, acceleration, and fulness of pulse. In the mildest cases these symptoms are scarcely appreciable. The child is observed to sneeze and have some deflexion from the nostrils, and this is followed by an occasional

mild, almost painless, cough, which declines in the course of a few days. The respiration and pulse are scarcely accelerated, and the appetite is but slightly impaired. There may be a little fretfulness, but the child is not confined to his bed or room, and usually amuses himself with his playthings. Auscultation in these mild cases reveals coarse mucous râles in the larger bronchial tubes, while the smaller tubes are free from mucus. Sibilant and sonorous râles are also observed, especially in the commencement of the bronchitis, at which time the secretion of mucus is suppressed or scanty. The cough in the commencement is for the same reason dry. It becomes looser by the second or third day, the sputum consisting of frothy mucus, with the admixture of pus and epithelial cells. The pus becomes more abundant as the disease continues. Expectoration does not usually occur till after the age of four or five years; under this age the sputum is ordinarily swallowed.

The mild form of bronchitis described above, that in which only the larger bronchial tubes are affected, is common at all periods of infancy and childhood, but a severer grade of the disease is also of common occurrence, exclusive of those cases in which the minute branches of the bronchial-tree are affected. It has already been stated that there is a tendency in bronchial inflammation to extend downwards, and symptoms are proportionate in gravity to the degree of this extension. In severe bronchitis the pulse rises to 120 or 130 per minute, and the respiration is in a corresponding degree accelerated. The cough is frequent and painful, the pain being referred to the sternum, and often there is a steady dull pain in this region. The face is flushed and indicative of suffering, the temperature is considerably elevated, and the appetite is greatly impaired or lost. There is frequently an exacerbation of symptoms in the latter part of the day. Depression of the infra-mammary region during inspiration and dilation of the alae nasi accompany grave attacks of the inflammation.

Auscultation in severe bronchitis reveals the presence of râles in all parts of the chest, sibilant and sonorous sparingly, coarse mucous and sub-crepitant more abundantly.

Capillary bronchitis or suffocative catarrh, the most dangerous form of this inflammation, is less frequent than bronchitis, which is limited to the larger tubes, or to the larger tubes and those of medium size. It may commence quite abruptly, but ordinarily

it results from the milder form of the disease. The symptoms at first are such as occur in the common form of bronchial inflammation, but instead of abating or remaining stationary, they gradually increase in severity till, suddenly, marked dyspnoea supervenes. The inflammation has now reached the minute tubes, and what promised to be an ordinary attack of bronchitis becomes one of great severity and danger.

The respiration in capillary bronchitis is short and hurried. Sixty to eighty inspirations per minute are not infrequent, while the pulse also is greatly accelerated, attaining as high a number as 140 to 160 or 180 beats per minute. The cough is frequent, and the sputum, which collects in abundance, is expectorated with difficulty. If expectorated so as to be examined, it is found to consist largely of frothy mucus with epithelial cells. After a few days, if the patient live, it becomes more purulent. Sometimes, as in bronchitis of the adult, streaks of blood appear upon the mucus. In the first days of capillary bronchitis, the temperature is considerably elevated, the face flushed, and indicative of suffering. The patient is restless, moving from one part of the bed to another, seeking in vain for relief. The digestive function is impaired, as in all severe inflammations; the tongue is moist and covered with a light fur; the appetite is nearly or quite lost. The nursing infant nurses with difficulty, frequently relinquishing the breast on account of the dyspnoea; older children take no solid food in consequence of the anorexia and the dyspnoea, and even drinks are swallowed hastily and apparently without relief, since deglutition interferes with respiration. On auscultation in capillary bronchitis, at first sibilant, and, after a day or two, sub-crepitant rales are observed in every part of the chest. Percussion elicits a good resonance, unless the substance of the lung has become involved. As the disease approaches a fatal termination, the pulse becomes greatly accelerated, the respiration is also in a corresponding degree frequent and panting, the inspiration being accompanied by marked infra-mammary depression and dilation of the alæ nasi. The face becomes pallid, the prolabia livid, and the tips of the fingers livid and cool. The mucus and pus accumulating in the air passages, increase more and more the obstruction to the entrance of air, and, finally, death occurs from asphyxia. The nursing infant usually ceases to nurse for several hours before death, and a

state of stupor commonly precedes the fatal event, in consequence of the carbonaceous state of the blood. In young infants, especially those under the age of six months, not only in capillary bronchitis, but in severe ordinary bronchitis, I have often observed toward the close of life, intermissions in the respiration. It occurs after every six or eight or ten respirations, and equals in duration the time occupied in, perhaps, half a dozen respiratory movements. It is, therefore, an unfavorable prognostic, but some recover by stimulation in whom it occurs.

The duration of acute bronchitis varies according to the extent of the inflammation. In the mildest form, the patient is convalescent after three or four days, and in severer forms that terminate favorably, the disease begins, ordinarily, to decline by the close of the first week or in the second. The progress of bronchitis is somewhat more rapid in young children than in those of a more advanced age. When convalescence is fully established, it is not unusual for the cough to continue three or four weeks, though gradually declining. It is hoarse and painless, and is scarcely regarded by the patient.

Death sometimes occurs as early as the second or third day in capillary bronchitis. The younger the infant, with the same extent and intensity of inflammation, of course the sooner the fatal result. The ordinary duration of fatal bronchitis is from six to eight days. If the patient pass beyond the tenth day, decline of the inflammation may be confidently expected, and recovery, unless there is a complication.

Occasionally bronchitis becomes chronic, lasting several months before it entirely ceases. The chronic form may result from mild, as well as severe bronchitis. The active fever and accelerated respiration which characterize the acute affection, abate, and the general health is nearly or quite restored; but an occasional cough continues, and the respiration is often audible, from the mucus which collects in the tubes, or from thickening of the mucous membrane. Sometimes there is moderate febrile movement, especially in the latter part of the day. On auscultation, coarse mucous, with perhaps sibilant and sonorous rales, are observed in the chest.

There is great liability in chronic bronchitis to exacerbations. The disease often seems to be abating, and there is prospect of its speedy cure, when all the symptoms suddenly are intensified.

This arises from the fact that the bronchial surface, when it has been a considerable time inflamed, is very sensitive to the impression of cold. Even when the disease is entirely relieved, it is very apt to return by exposure to currents of air or changes of temperature. Chronic bronchitis occurs most frequently in the winter and in the spring and fall, when the weather is changeable, and is most intractable in those periods of the year. Many cases of chronic bronchitis are associated with dilatation of the bronchial tubes or with emphysema. The general health in chronic bronchitis when not dependent on a tubercular deposit, ordinarily remains good. Tubercular bronchitis, which is the result of a grave disease, does not require a separate consideration. It is attended with emaciation, and is obstinate on account of the nature of the primary affection. It is due to the irritating effect of tubercular matter lying against the bronchial tubes.

DIAGNOSIS.—Bronchitis can, ordinarily, be diagnosed by the character of the respiration and cough. The absence of hoarseness, stridulous inspiration, and croupy cough, excludes laryngitis, and the absence of the expiratory moan and of the stitch-like pain on coughing, which characterize pneumonia and pleurisy, exclude those diseases. Accurate diagnosis, however, can be most readily made by percussion and auscultation. Examination of the chest enables us to state with positiveness, not only the nature, but the extent of the affection. If the inflammation is confined to the larger bronchial tubes, coarse rales are discovered in them, while finer mucous rales are absent. If the bronchitis is capillary, subcrepitant rales are discovered in the smaller tubes. Percussion gives clear resonance on both sides, except in those instances in which collapse or pneumonia has occurred.

PROGNOSIS.—Bronchitis, limited to the larger bronchial tubes, or to these and those of medium size, terminates favorably in a large majority of cases. Occasionally, severe inflammation, not extending to the smaller tubes, proves fatal in young infants, or those of feeble constitution. True capillary bronchitis is, on the other hand, a disease of great danger. It may be fatal at any period of childhood, but the younger the patients and more feeble, the greater the proportion of deaths. Under the age of one year, it is one of the most fatal diseases of early life.

The prognosis in the commencement of all cases of bronchitis

of average severity in the young child, should be guarded on account of the tendency of the inflammation to extend, since ordinary bronchitis may become capillary. After five or six days extension ceases, and, if during that time there is no increase in the severity of symptoms, the prognosis is favorable. Signs which indicate an unfavorable result, are increasing frequency of pulse and respiration, difficult and scanty expectoration, restlessness, a countenance indicative of suffering, and a progressively greater accumulation of mucus in the bronchial tubes, as determined by auscultation. Pallor and coldness of the face and extremities, lividity of the tips of the fingers, rapid and feeble pulse, drowsiness, diminution of cough, while the mucus and pus accumulate in the bronchial tubes, and, in young children, intermissions in the respiration, indicate the near approach of death. Cases may, however, recover by proper treatment, although the symptoms are most unfavorable.

It is unnecessary to mention the favorable prognostic signs of bronchitis. This disease, when fully established, continues a certain number of days, whatever remedial measures are employed, and if the symptoms do not increase in severity during the first five or six days, a favorable result is highly probable. The prognosis in chronic bronchitis is ordinarily favorable, so far as life is concerned, provided there is no emaciation. If there is emaciation, the bronchial inflammation may be due to tubercles in the bronchial glands or lungs, and, of course, the prognosis is unfavorable.

TREATMENT.—Bronchitis may be rendered much milder, and, perhaps, even prevented, by an emetic employed in the first twelve or twenty-four hours, in conjunction with a warm bath. The physician is not, however, ordinarily called sufficiently early to render this treatment effectual. The remedial measures proper for this disease vary greatly, according to the stage and intensity or extent of the inflammation and the age of the patient. Bronchitis, *limited to the larger tubes*, requires the most simple measures. A laxative may be employed, with a mild expectorant, and moderate counter-irritation should be produced by camphorated oil, or the occasional employment of a sinapiem. I have sometimes ordered for these mild cases, a mixture recommended by Dr. James Jackson, of Boston, in his letters to a young physician. "For young children," . . . says he, "I employ the

following: Take of either almond or olive oil, of syrup of squills, of any agreeable syrup, and of mucilage of gum acacia, equal parts, and mix them. Of this mixture, a teaspoonful may be given to a child at two years of age; a little less if younger, and increased if older, so as to double the dose to one in the sixth year. This may be given from three to six times in the twenty-four hours. Sometimes a little opiate must be added at night to appease an urgent cough. These cases also do well with simple mucilaginous drinks in conjunction with gentle aperients.

Bronchitis, extending beyond the primary or secondary bronchial divisions, requires more careful watching and more decided measures. The abstraction of blood by leeches, or otherwise, is seldom required in the treatment of bronchitis. Occasionally, if the inflammation is intense and the symptoms urgent, moderate abstraction of blood at an early period may be useful, but the employment of cardiac sedatives under such circumstances is generally preferable.

As a rule, actively depressing agents should be avoided in the treatment of bronchitis in patients under the age of two years; and, on the other hand, sustaining remedies are in a large proportion of cases required after the first two or three days. Many infants with bronchitis are sacrificed in consequence of the old theory, which still influences medical practice, that an inflammation, with its increased force of circulation, is necessarily best controlled by depletory and sedative measures. Remedies too depressing are prescribed, and with a less favorable result than would follow a strictly expectant course of treatment.

What is, therefore, the proper mode of treating bronchitis, severe or of ordinary gravity, occurring in infancy and childhood? It is supposed that the physician is called, when the inflammation is fully established, or that if he has seen the patient at the commencement, and has prescribed an emetic, it has failed to throw off the disease. A sinapism should be immediately applied over the chest till it has reddened the surface, and to the infra-scapular region. The chest should then be surrounded by an oil-silk jacket, under which, if the patient is an infant, a single thickness of muslin is placed, in front and behind, saturated with camphorated oil. Except in the youngest patients it is often advisable to prescribe camphorated oil with a greater proportion of camphor than is contained in the official prepara-

tion, in order to render it more irritating, or about one-eighth part of turpentine may be added to it. The vapor of the camphor confined by the oil-silk will often produce sufficient counter-irritation, after the surface has once been reddened by the mustard; but if it do not, the sinapism should be reapplied after a few hours, or an irritating liniment may be employed. On account of the fact that much of the oil-silk now kept in the stores is inferior, and soon becomes filled with holes, it is my practice to order a thin and light poultice of ground flaxseed to be placed upon the chest, under the oil-silk, and over the camphorated oil. It has the advantage of being more readily kept in place than the oil-silk, which is apt to be crumpled and pushed aside.

Local treatment in bronchitis is very important. The exact mode of applying it, or the substances used, matters little, provided it meets the indication, which is twofold—namely, derivation to the surface, and the application to it of warmth and moisture. Such applications are found, by experiment, to give most relief. Warmth and moisture are furnished by cataplasms most conveniently, or by warm water applications under oil-silk, or by oil-silk alone, which, snugly bound upon the chest, promotes perspiration underneath.

Derivation to the surface, early made and repeated, tends to check the downward extension of bronchitis; but it is not advisable to vesiccate, or to produce anything more than moderate and continued redness. Often improvement in symptoms is observed, especially less dyspnoea and restlessness, immediately on the employment of the local measures recommended above.

The general or internal treatment appropriate for bronchitis varies according to the age and the character of the inflammation, whether primary or secondary. The following formula will be found useful for infants affected with primary bronchitis:—

R.—Spts. ether silt. ʒj;
Syr. ipecacuanhe.
Ol. ricini, aa ʒij;
Syr. cal. tolat. ʒviij.—Miscr.

Give teaspoonful for an infant one year old every two to four hours.

Another eligible formula is the following:—

R.—Syr. ipecacuanhe ʒij;
Potas. acetat. gr. ssj-ʒss;
Aq. anis ʒxij.—Miscr.

Dose, one teaspoonful for an infant of six months.

If there is decided febrile reaction, tincture of digitalis, one or two drops, according to the age, may be added to each teaspoonful.

In a majority of cases of infantile bronchitis, this mode of treatment is appropriate only for the first few days, after which, if farther medication is required, more sustaining, or even stimulating medicines are proper.

For children over the age of three years, if the previous health has been good, and the bronchitis is primary, acute, or venereum viride, is often useful in the first stage of the inflammation. The following is a recipe for a child of five years:—

R.—Tinct. verat. virid. gr. xij;
Syr. scilla comp. 5j;
Syr. bal. tobt. ʒiiv.—Mucc.

One teaspoonful every two to four hours; the medicine to be omitted, or given at a longer interval, if the frequency of the pulse is relaxed.

The effect of cardiac sedatives should be carefully watched. In general they should be administered only during the first three to five days; but if the child is robust, with full and strong pulse, they may be continued longer. As the active inflammation begins to abate, simple expectorant mixtures may be given, as syrup of squilla, or ipocacuanha in spiritus Mindereri. At this stage of bronchitis, it is often best to commence the use of stimulating expectorants, and they are required in nearly all cases of advanced bronchitis. In secondary forms of the disease, as when it occurs in connection with whooping-cough or measles, such expectorants should be employed from the first; and also if there is a state of feebleness or cachexia, although the bronchitis is primary. It is important for successful practice to be able to determine at what period in the disease this class of medicinal agents should be prescribed. In doubtful cases, it is safer to prescribe them than those of a depressing character; but it is better to employ, for a day or two, a simple mucilaginous or other soothing mixture, after which a stimulating expectorant can be given. A favorite prescription with me is the following:—

R.—Alumen, calcinat. gr. xvj-xxiv;
Tinct. scirrhos. gr. xxiv;
Syr. scilla ʒij;
Ext. glycyrr. ʒss;
Aq. ʒiiv.—Mucc.

Dose, one teaspoonful every three or four hours, in a child of two years.

If there is restlessness Dover's powder, purgative, or syrup of poppies should be given with this mixture, or separately.

As convalescence approaches, the medicine should be given less and less frequently or in smaller doses. Emetics in ordinary cases of bronchitis are not required, except in the commencement. In severe bronchitis, however, especially when the smaller tubes are inflamed, they are sometimes of great service. The cases which require their administration are those in which mucus and pus collect in the tubes more rapidly than they are expectorated, so as to give rise to urgent dyspnoea. Nothing gives such decided and immediate relief under these circumstances as an emetic. The object to be gained is obviously very different from that in the commencement of bronchitis, and such agents should be employed as act promptly, with the least possible depression. Sulphate of zinc or of copper is therefore an appropriate medicine. The former may be given in a dose of five grains; the latter of one or two grains to a child five years old. If there is considerable strength of pulse and heat and dryness of surface, ipecacuanha may be administered. If there are evidences of exhaustion, stimulants may be administered immediately before and after emesis. Infants oppressed by the accumulation of mucus and pus may sometimes be relieved by tickling the fauces with the finger. This provokes vomiting, and the viscid mucus which collects at the entrance of the glottis is removed by the finger.

In secondary bronchitis, whatever the age, in primary or secondary occurring in infants or feeble children, the diet should, as a rule, be nutritious through the entire disease. Robust patients, or those who have had ordinary health, if over the age of two years and affected with primary bronchitis, should have light diet, chiefly farinaceous in the first days of the attack, after which animal broths are proper. Whatever food is given in severe bronchitis must be in the form of drinks, since the appetite is lost, while the thirst is such that liquids are less likely to be refused.

In primary bronchitis, if mild or of ordinary severity, alcoholic stimulants are not required. In secondary bronchitis they are often needed, and also in capillary or severe ordinary bronchitis if there is dyspnoea with evidences of prostration. The occasional loose cough which is often present during the period of convalescence, requires but little treatment; either no medicine or a gently stimulating expectorant may be given.

CHAPTER V.

PNEUMONITIS.

PNEUMONITIS, pneumonia, or inflammation of the substance of the lungs, is less frequent than bronchitis. It is, also, less frequent in infancy than was formerly supposed, since we now know that a lesion not infrequently observed in the lungs of the infant, and which was, till recently, believed to result from pneumonia, occurs independently of that disease. The lesion referred to is lobular collapse, an occasional result of capillary bronchitis, and already described in our remarks upon that disease.

Pneumonitis differs materially in the two periods of life, infancy and childhood. In childhood it is commonly primary and lobar, as in the adult; on the other hand, in the infant, especially under the age of eighteen months, it is rarely primary and lobar, but is secondary and confined to a part of a lobe. Hence two forms of this inflammation must be recognized, namely, primary and secondary, according to causation, and also lobar and circumscribed or lobular, the distinction depending on the extent of the inflammation.

CAUSES.—Pneumonitis in early life is frequently due, as it ordinarily is in the adult, to atmospheric causes, namely, to vicissitudes of temperature, to exposure to currents of air, or to cold. It is, therefore, most frequent in cold and changeable weather. Pneumonia, occurring from such causes, does not differ materially from the same disease in the adult. It is ordinarily lobar. It is more frequent in the right than left lung. In whichever lung it occurs its most common seat is the lower lobe. It, however, not infrequently affects the upper lobe on the right side, though very rarely that on the left side, unless at the same time the lower lobe is involved.

Pneumonitis is also a common complication of tuberculosis, measles, and hooping-cough. In the first it is produced by the irritating effect of the tubercular matter; while in the other two

it is caused by the *materies morbi* of those zymotic affections. The tubercular deposit is more apt to excite pneumonitis in the young than in the adult, and pneumonitis due to such a cause is apt to be extensive on account of the dissemination of tubercular matter. Tubercular inflammation is persistent, and gives rise to symptoms and physical signs which mask those of the primary disease.

Pneumonia in both measles and whooping-cough is a serious complication, increasing greatly the percentage of fatal cases. It is not so common in either disease as is bronchitis, though more dangerous.

Hypostatic congestion has long been regarded as a cause of pneumonia in the infant. Billard, forty years ago, wrote: "Pneumonia of infancy presents peculiar characters, in which it differs from the same affection in adults. Instead of being an idiopathic affection arising from irritation developed in the pulmonary tissue under the influence of atmospheric causes, which often excite the disease, the pneumonia of young infants is evidently the result of a stagnation of blood in their lungs. Under these circumstances this blood may be regarded as a kind of foreign body. . . . It would, therefore, appear that inflammation of the lungs, which produces hepatization, arises in infants, in general, from some mechanical or physical cause."

Solidification of the lung tissue as a result of passive congestion does not often occur, except in infancy. It occurs, or a state similar to it, in the course of typhus and typhoid fevers in the adult. Dr. Swett, in his treatise on *Diseases of the Chest*, alluded to it in the following remarks: "There are certain conditions of the lung in which the appearances differ so much from the usual consequences of inflammation that they have excited particular attention and have received distinct names. One of the most striking is that known as splenization of the lungs, a condition not very infrequent in continued fever. In this case the portion affected, and it is usually the base of the lung, is swollen, bluish, or dark red. It is very much softened, giving out, when pressed, a viscid, grumous, dark-red, macerated fluid. The lung, in fact, resembles quite as much the spleen as it does the liver in cases of hepatization. This condition is pneumonia in the first stage, or, more properly, the imperfectly developed second stage united with venous congestion and unusual softening of the tissues."

It is still an undecided question in pathology whether simple

congestion, when protracted, does sometimes give rise to inflammation, and is, therefore, to be regarded as its cause. It is difficult, indeed, to determine this point until we ascertain the nature of inflammation, and what pathological processes it is proper to consider as such. Examples are not wanting of the occurrence in other organs than the lungs of a state akin to inflammation, if not true inflammation as a result of congestion, as, for example, the state of the kidneys in certain cases of Bright's disease, where the only assignable cause is repeated or long-continued congestions, and the state of the spleen and gastro-intestinal mucous membrane in certain cases of cirrhosis in which there is chronic congestion of the portal system.

The peculiar state of solidification which occurs in a lung from long-continued hypostatic congestion, differs in some respects from the ordinary form of pneumonia. It is apt to be bilateral, affecting the posterior portions of the lobes; its color is a dusky red, and it does not give rise to inflammation of the pleura, which covers it. On the other hand, if the hypostatic congestion has been of long continuance, the affected portion of lung is non-crepitant, not susceptible of inflation, softened; its volume is somewhat increased, not only from congestion of the capillaries, but from cell increase. The microscope shows an augmentation in the number of cells in the part, though not to the extent which is observed in the ordinary form of pneumonia. Furthermore, some of the cells cannot be distinguished with our present means of observation, from those which are produced so abundantly in the ordinary form of pneumonia.

For convenience of description, I shall apply the term hypostatic pneumonia to this condition of lung, believing that it resembles pneumonia more than any other recognized pathological state. There is reason to believe that pulmonary collapse of infancy, attended as it is, with more or less congestion, does sometimes end in the same form of pneumonia. It is not unusual to find at the autopsies of infants who have died in a state of feebleness and emaciation, portions of the lungs remote from the bronchi collapsed, as, for example, the thin edges of the inferior lobes, and the tongue-like process of the left upper lobe, the process which lies over the heart. These parts, though obviously primarily collapsed, have sometimes considerable thickness and firmness, and cannot be inflated, if this state of the lung has con-

tinued a considerable period. In parts thus affected we find by the microscope, round granular cells in the air cells, which bear a close resemblance to those which are developed in pneumonia, if, indeed, they are not identical with such.

If we admit that hypostatic congestion may give rise to pneumonia, it is not difficult to understand how pulmonary collapse might give rise to it, since, if an air cell is collapsed, the vessels which surround it become congested. The functional activity of an organ favors circulation through it, and if the function is abolished, as in collapse of the lung, the flow of blood in the part is retarded, and stasis more or less complete results. There is then a state of the lung as regards the bloodvessels, which is very similar to hypostatic congestion.

This subject, as well as many others, in infantile pathology, requires farther elucidation. It will be better understood when pathologists devote to the morbid anatomy of infancy a share of the attention which they bestow upon that of the adult. In cachectic and wasted infants, those lying almost constantly on their backs, no pathological state is more frequent than that described above, namely, hypostatic congestion ending in solidification. According to Valleix, the greater part of the infants who die in the *Enfants Trouvés*, are found to have hepatization. The same state of lung is often observed at the autopsies of wasted infants, especially foundlings who die in the Infant's Service of Charity Hospital, and in the Nursery and Child's Hospital of this city.

The question whether capillary bronchitis may sometimes give rise to pneumonia by extension of the inflammation into the air cells has been alluded to elsewhere. The affirmative is rendered highly probable by the fact often observed in practice, that an infant is taken with bronchitis, and for several days, auscultation and percussion reveal only the physical signs of that disease. After a variable period, signs of hepatization are developed. The physical signs and the clinical history show that the disease is a true broncho pneumonia. It is my opinion, therefore, that capillary bronchitis sometimes ends in pneumonia, and in other cases, or in other parts of the lungs in lobular collapse, and that the former is probably not much less frequent than the latter.

In rare instances in infancy and childhood, as well as adult life, lobular pneumonia may result from arrest in the capillaries of the

lungs of particles of fibrin detached from a clot, which has formed in some remote vein, in consequence of arrest of circulation in it, by inflammation of the contiguous tissues. A specimen showing this mode of causation was exhibited by me at the New York Pathological Society, in February, 1868. An infant born January 22d, 1868, of strumous parents, had been unusually fretful, but without appreciable ailment till February 5d, when cellular inflammation was discovered on the anterior aspect of the left leg, a little below the knee. This extended downwards, suppurated, and the pus was evacuated February 5th. In the meantime, three other similar inflammations occurred, two on the right foot and leg, and the other over the parietes of the chest in the right infra-mammary region. Suppuration occurred in all of these.

On February 8th this infant was suddenly seized with extreme dyspnoea, and died in a few hours. Numerous minute poriform collections (formerly called metastatic abscesses) were discovered in each lung, most of them scarcely larger than a pin's head. One of these on the right side in the middle lobe connecting with a bronchial tube had ruptured into the pleural cavity causing pneumo-thorax, collapse, and incipient pleuritis.

The following figure exhibits the microscopical appearance of this softened fibrin, which, to the naked eye, so closely resembled pus.



On account of the speedy death, this substance had produced in the points where it had lodged, little more than congestion or the first stage of pneumonitis around it.

ANATOMICAL CHARACTERS.—The structural changes occurring in pneumonitis, in infancy and childhood, are best considered under the two heads already indicated, namely: first, lobar;

secondly, circumscribed or lobular—the former common in the child as well as adult, and rare in the infant; the latter common in the infant, and rare in the child.

Lobar pneumonitis presents nearly the same anatomical characters at all periods of life. Commencing at some point in the lobe, it soon invades the whole of it. In extensive inflammation, two or more entire lobes are affected, the disease not passing from one to the other, but occurring independently in each lobe.

Lobar pneumonitis in the child, as in the adult, has three stages—that of engorgement, and of red and gray hepatization. In the first stage, the capillaries surrounding the air-cells are distended, and exudation commences of the liquid portion of the blood into these cells. The engorgement produces some increase in volume and weight of the part affected, but its specific gravity is still less than water. It has a dull red color, and is slightly softened; frothy, sanguineous liquid escapes from its incised surface.

In the second stage the air-cells are filled with round, granular, nucleated cells, very similar in appearance to pus cells. These cells are mixed with epithelial cells, blood cells, compound granular cells, and amorphous matter. The round, granular, nucleated cells are developed in great abundance. They have sometimes been called corpuscular fibrin, and in this city are known as the pneumonic cells, the name applied to them by Prof. Alfonso Clark, who was one of the first to describe them. They occur in much greater abundance than all the other cells, and the increased solidity and specific gravity of the lung is due almost wholly to them. According to the old theory, they are developed in the liquor sanguinis, as in a blastema, after its exudation into the air vesicles. According to the doctrine of proliferation, they are produced by the multiplication and altered growth of nuclei in the connective tissue, or of epithelial cells.

In the second stage of lobar pneumonitis, the lung presents a dull red color, like that of the healthy liver. Its volume is somewhat increased from the distension of the air vesicles. It is considerably softened, so as to be readily torn or penetrated by the finger, and it sinks rapidly in water. In the adult, its incised or torn surface is distinctly granular, each granule being the contents of an air cell. In the child the air cells are smaller, and

the granular appearance is less distinct. In the infant it is not observed, or scarcely observed, by the naked eye.

M. Bouchut states that the lung of the child in the second stage of pneumonia, can be inflated, as it confessedly can be in the first stage. This statement needs modification. From a pretty large number of observations which I have made, I am convinced that the lung in this stage of *lobar* pneumonia is impermeable to air, although strong insufflation is employed. In *lobular* pneumonia, the pneumonia of infants, which in a large proportion of cases is secondary, and in which, I believe, that the air cells are often not so distended by inflammatory products, I am of opinion that partial inflation is possible. Observations to determine this point require to be conducted with great care, with careful selection of specimens, since other pathological states may be mistaken for inflammation.

By strong insufflation of a lung which, to the naked eye and by the microscope, presents the characteristics of true lobular pneumonia, the air can often be made to encroach somewhat on the solidified area, but in most instances complete inflation is impossible. I have sometimes employed such force of the breath as to cause emphysema, with the effect which has been stated. In exceptional instances there has been the appearance of complete inflation. Perhaps air, in these cases, enters the air cells, passing between the cell walls and the contents. Sometimes certainly, where there is the appearance of inflation, air has escaped into the tissue between the air cells and under the pleura, whether or not it has likewise entered the air cells. In these cases of real or apparent inflation, the lung still feels firm under the finger, with but slight crepitation.

To repeat, the conclusion, therefore, at which I have arrived as regards the subject of inflation, is, that in lobar pneumonia in the child, the pneumonia which is rare before, but is common after the age of two years, and which, like the same disease in the adult, is ordinarily due to atmospheric causes, but which is sometimes secondary, as in measles or whooping-cough, the hepatised lung cannot be inflated. On the other hand, in lobular pneumonia, which is for the most part secondary, the pneumonia of the first and second years, an inflammation less acute than the other form, subsists rather than acute in many

instances, partial inflation is possible, and, in some, complete inflation.

In the second stage of *lobar pneumonia* there is no crepitation, and little or no liquid escapes from the cut surface. The blood cells, mixed with the inflammatory product, dissolve in a few days, and the hæmatis begins to disappear. What was before red becomes grayish, and like the third stage, or that of gray hepatization, *lagime*. The gray color is due, not only to the disappearance of the coloring matter, but to the fact that the cells which fill the air vesicles become more granular. They begin to undergo fatty degeneration. In the commencement of the third stage, the lung is still non-crepitant and much softened. In favorable cases, the inflammatory cells becoming fatty, liquefy, and are absorbed, or in part expectorated. In children, the disappearance of the inflammation and return to health are more rapid than in the adult.

In comparatively rare cases, what has been designated *purulent infiltration* occurs. The disease is then protracted. A troublesome cough, with emaciation and hectic may result, and the case be fatal. *Lobar pneumonia* often causes inflammation of the portion of the pleura which covers it. *Pleuritis* developed in this way is circumscribed, but it frequently extends beyond the pneumonia to the distance of one or two inches. *Bronchitis* is, also, a common accompaniment of *lobar pneumonia*. It may be general, in which case it occurs independently; or be limited to the tubes lying within the inflamed lung, in which case it results like *pleurisy* from the pneumonia.

Little need be added to what has already been stated in reference to the anatomical characters of *lobar pneumonia*.

Those who have witnessed but few post-mortem examinations of young children, are apt to suppose that, in the circumscribed or *lobular pneumonia* of infancy, there is an alternation of sound and inflamed lobules, so that the surface of the lung presents an appearance not unlike mosaic work. This is a mistake. In *lobular pneumonia* there is usually continuous inflammation extending over several lobules, though occasionally in specimens lobules are seen near the edge of the inflammation which have escaped, and which are entirely surrounded by inflamed lung.

The extent of the inflammation is very different in different

casts. I have seen a nodule of true inflammation not much larger than a pea, while every other part of the organ was healthy. Ordinarily, however, the diameter of the inflamed portion is one, two, or even three inches. The third stage occurs less frequently in lobular than in the other form of inflammation.

In the pneumonitis of infancy and early childhood, when protracted, small abscesses are apt to occur; their diameter is from half a line to one or two lines. They often lie near the surface of the lung, and they sometimes give rise to circumscribed pleurisy, which unites the lung to the walls of the chest. These abscesses occasionally, perhaps ordinarily, connect with bronchial tubes, and on attempting to inflate the lung removed from the chest, I have sometimes observed the air escape from the aperture which corresponded with an abscess which had either opened into the pleural cavity before death, or had been torn in separating the adhesions. In one or two cases of young infants whose bodies I have examined after death, pneumothorax and collapse had apparently occurred in this way.

Pneumonitis, which supervenes in measles and whooping-cough, has, usually, as I have observed it, been lobar and accompanied by circumscribed pleurisy. Death in most cases of fatal measles, is due to this inflammation. The most obstinate and fatal form of pneumonitis in infancy and childhood is the tubercular.

SYMPTOMS.—Lobar pneumonitis commonly begins abruptly, or it is preceded for a brief period by symptoms of a cold. In the adult, the abrupt commencement is ordinarily with a chill. In the child, there is often a sensation of chilliness, but a distinct chill is not common. Convulsions sometimes occur in place of a chill. Lobular pneumonitis being ordinarily a secondary disease, begins in a more gradual way. It is, of course, when secondary, preceded by, and associated with, the symptoms of the primary affection.

The symptoms of acute pneumonitis, lobar or lobular, are the following: Anorexia, thirst, restlessness, elevation of temperature, acceleration of pulse according to the intensity of the inflammation and the feebleness of the patient, flushed face, a countenance indicative of suffering, accelerated respiration, with an expiratory moan. These symptoms are constant in acute pneumonitis, unless in the mildest form. Those which are important I shall describe more fully.

The expiratory moan is described by writers as a pathognomonic symptom of this disease, or of pleurisy. It is evidently due to the pain experienced by the friction of the inflamed pleura. As a rule, the expiratory moan does indicate either pneumonia or simple pleuritis; but there are exceptions. It may occur, for example, from indigestible substances in the stomach and intestines, giving rise to acute dyspepsia; or from certain forms of abdominal inflammation, which render movements of the diaphragm painful.

Soon after the commencement of pneumonia a cough occurs, which in the first days is dry or hacking, and painful. It afterwards, if the case is favorable, becomes looser, and is painless. We very seldom observe in the child the bloody sputum which characterizes pneumonia in the adult. The sputum, at first, is either absent or it consists of frothy mucus. In the declining period of the disease it consists of mucus-pus. There is often, in the first period of the inflammation, pretty severe and constant headache, the patient complaining of the head, if old enough to speak, before he does of the chest. He usually, in severe cases, at this period lies with the eyes shut, apparently in a half-conscious state, fretful if spoken to or if aroused, so that the physician might be led to suspect the presence of cerebral disease. If there is vomiting, accompanied with sudden twitching of the muscles, and convulsions—symptoms which sometimes occur—the liability to error in diagnosis is greatly increased. Cerebral symptoms are more prominent in the commencement of pneumonia than subsequently. As the disease advances, they subside, and symptoms referable to the chest become more conspicuous.

The breathing is, as I have said, accelerated. Thirty or forty respirations per minute are common, and, in severe cases, the number reaches sixty or even eighty. In infants there is greater frequency of respiration than in children. In those at the breast, if the dyspnoea is urgent, nutrition is sometimes seriously interfered with, since in these severe cases respiration is performed more through the mouth than nostrils, so that if the infant seizes the nipple, it is forced to relinquish it in order to breathe. Dilation of the alae nasi, and depression of the infra-mammary region, accompany inspiration. The dyspnoea is sometimes due, in great measure, to accompanying bronchitis.

The temperature in mild cases of pneumonia is elevated to

about 101° to 103° ; in severe cases it may reach even 107° . In ninety-seven observations made by M. Roger, the average temperature was 104° during the active period of the inflammation. The face is therefore flushed, and the heat of surface pungent, except in weakly children, in whom, even in severe and active inflammation, the face is sometimes pale, and the extremities of natural or less than natural temperature.

The tongue is moist, and covered with a light fur; the thirst is such that nutriment may be given in the form of drinks, when the loss of appetite prevents the use of solid food. The bowels are usually constipated. The secretions, in the first and second stages, are diminished. The urine is more deeply colored than in health, and in vigorous patients it deposits urates on cooling. The chlorides are also deficient, or absent from the urine, as long as the inflammation is extending.

In favorable cases, in from seven to ten days the heat and thirst decline; the pulse and respiration gradually become less frequent; the cough looser; the features have a more placid or contented expression; the appetite returns, and the patient is again amused by playthings. The improvement is progressive, but gradual. A slight cough is occasionally observed for two or three weeks after convalescence is fully established.

Death commonly occurs from asthenia. The pulse gradually becomes more frequent and feeble, the respiration more oppressed, and finally, as death approaches, the face and extremities become cool. If death occur from apnea, it is due in great part to co-existing bronchitis; rarely it may result from convulsions, followed by coma, especially in the first week.

Such is the clinical history of ordinary acute pneumonitis. The symptoms and course of that form of the disease which occurs in feeble infants as a secondary affection, is different; sub-acute in its character in a large proportion of cases, and not accompanied by pleuritis, the respiration is but moderately accelerated, and is attended by little pain. The expiratory moan is therefore less marked than in the ordinary form of inflammation. There is an occasional short, dry cough, and the pulse is somewhat accelerated. This disease is often overlooked, the symptoms being referred to the primary affection, or to that and bronchitis. Many of these cases prove fatal by asthenia. Exceptionally death may occur in this form of pneumonitis from

the formation of a minute abscess, and the escape of pus into the pleural cavity, giving rise to pleuritis, or to pleuritis with pneumothorax.

Tubercular pneumonitis extends over much or little of the lung according to the amount of tubercles. The symptoms are like those of severe primary pneumonitis, superadded to such as pertain to tuberculosis. This inflammation, when once established in the consumptive child, commonly continues till the close of life. I have sometimes had these cases under observation for several consecutive weeks, even months, and during the whole time there was not only acceleration of pulse and respiration, but the expiratory noise. As regards pneumonia occurring in hooping-cough, it is an interesting fact that its symptoms supplant those of the primary disease, so that during the active period of the inflammation, the paroxysmal cough ceases, and the short hacking cough and expiratory noise occur in place. As the inflammation abates, the cough of pertussis returns. Pneumonia, occurring in measles, is more obstinate, protracted, and dangerous, than the primary form. It usually commences about the period of the decline of the eruption, and, in favorable cases, continues two or three weeks. It is then a sequel, rather than complication.

PHYSICAL SIGNS.—The physical signs of pneumonitis in infancy and childhood are the same as in the adult, but in a large proportion of cases they are less distinct. In a majority of patients under the age of three years the crepitant rale is not observed. This is due to the small size of the air vesicles at this age. I have now and then detected it in quite young children, in whom it is a finer rale than in the adult. If observed it is, of course, positive proof of the existence of pneumonitis. The physical signs, therefore, in the first stage of the inflammation are often obscure in consequence of the absence of the pathognomonic rale. The vesicular murmur is somewhat intensified through the chest, and there is in this stage slight dulness on percussion over the seat of the inflammation due to engorgement of the vessels, but it is difficult to appreciate this.

In the second stage, which rapidly supervenes, the physical signs are more distinct. Bronchial respiration is in most cases detected, higher in pitch than the vesicular murmur, and the sound of expiration higher than that of inspiration. The voice of the

patient is transmitted to the ear applied over the seat of the disease, and often a peculiar vibratory sensation is communicated to the hand applied over the part, so that it is possible to locate the disease by palpation alone. There are frequently, in the second stage, and sometimes in the first, coarse mucous rales in various parts of the chest from co-existing bronchitis.

Percussion, in the second stage, elicits a dull sound as compared with that produced on the opposite side of the chest. The dulness corresponds in extent with the solidification, and with the bronchial respiration.

As the inflammation abates the dulness on percussion gradually diminishes, and the bronchial respiration is succeeded by the subcrepitant rale. Often for a considerable period after convalescence is established moist rales are observed in the chest and sometimes the dulness on percussion does not entirely disappear till after the health is fully restored.

In lobular pneumonitis the physical signs are not so distinct. This is due in part to the limited extent of the inflammation, in part, in many cases, to its subacute character, and in part to the fact that this inflammation is apt to be double, especially in those frequent cases in which the cause of the disease is hypostatic congestion.

DIAGNOSIS.—In the adult pneumonitis is a disease of easy diagnosis. In infancy and childhood, on the other hand, diagnosis is often difficult. Acute primitive pneumonitis in young children is apt to be confounded with meningitis or one of the essential fevers if the examination be made within the first or second day. In children over the age of three or four years it is most frequently mistaken for remittent fever. The two diseases do, as regards symptoms, resemble each other. Both are characterized by great elevation of temperature, rapid pulse, languor, and drowsiness, and in both there is apt to be a cough even from the first day. But remittent fever (I include for the present under this term also typhoid fever) usually begins more gradually than pneumonitis. It is preceded for a few days by symptoms of mild indisposition, though there are exceptions, and it may commence quite abruptly. The expiratory moan occurring in pneumonitis in most cases by the second or third day is a symptom of great diagnostic value. But positive proof of the nature of the disease is afforded only by auscultation and percussion. Scarlet fever, in its commencement,

bears considerable resemblance to acute primitive pneumonia. The points of differential diagnosis are the redness of the buccal membrane and the fauces, and the efflorescence upon the skin in scarlet fever on the one hand, and on the other the rational and physical signs of pneumonitis, which have been described.

Greater difficulty attends the diagnosis of acute pneumonitis from bronchitis and pleuritis. The presence of the expiratory rales, if it is pretty constant and marked, is sufficient to exclude bronchitis, unless as a complication, but the physical signs constitute the only reliable means of exact diagnosis. The presence or absence of bronchitis is readily determined by auscultation. The physical signs should be carefully noted in order to determine if there is some point of solidification.

Solidification gives rise to dulness on percussion, bronchial respiration, and bronchophony. These three signs coexisting afford sufficient proof of pneumonitis, unless there is tubercular consolidation or possibly collapse supervening on suffocative bronchitis. The history of the case aids in determining whether there is either of these diseases. Moreover, collapse occurs later after the attack commences than hepatization, and does not produce so distinct bronchophony or bronchial respiration as are observed in the common form of pneumonitis.

Pleuritis with effusion, may present physical signs which bear considerable resemblance to those in pneumonia; but in pneumonia, except when associated with tubercular deposit, the dulness on percussion is not so great as that from pleuritic effusion, nor does the line of dulness vary according to the position of the child. In pleuritic effusion in a young child, the respiratory murmur can often be heard with the ear applied over the liquid, but it is indistinct, and transmitted through the liquid from a distance. The practised ear is able to discover the difference between it and the bronchial respiration of pneumonia. Attention to these facts enables us to make a positive differential diagnosis in most cases. Occasionally the physical signs indicate the coexistence of pneumonitis and pleuritis.

In lobular pneumonitis, it is often difficult to determine certainly the nature of the disease, since the physical signs, if there is but little extent of inflammation, are absent or indistinct. I have often, in post-mortem examinations, found so small a part of the lung hepatized that it could not possibly have produced any

appreciable dulness on percussion, bronchial respiration, or bronchophony. On account, therefore, of the indistinctness of physical signs, and the fact that the symptoms are often slight, the diagnosis of circumscribed pneumonitis is much more difficult than that of the lobar form. Cases are apt to pass for bronchitis, and, practically, this matters little, since the treatment required by the two is not dissimilar.

PROGNOSIS.—Primary pneumonitis, affecting only one lung, if properly treated, in most instances terminates favorably in children, and even in infants. If double, it is, as in the adult, much more serious, and, in a large proportion of cases, fatal. Secondary pneumonitis, pneumonitis occurring in measles, hooping-cough, tuberculosis, or resulting from hypostatic congestion in the course of some exhausting disease, is, on the other hand, more frequently fatal. As death usually occurs from asphyxia, the younger the child, and more feeble the constitution, the greater the danger.

Unfavorable symptoms are, a pulse becoming more and more frequent and feeble, pallor of countenance, inability of the patient to support the head, total loss of appetite, refusal to notice or be amused by playthings, absence of tears when crying—a symptom which the French writers have pointed out—and the appearance of pemphigus on the face or elsewhere.

Indications on which a favorable prognosis may be based, are moderate acceleration of pulse, pneumonia primary and limited to one side, ability to support the head or sit erect, being amused by playthings, etc.

TREATMENT.—The treatment of the two forms of pneumonitis, lobar and lobular, requires to be considered separately, as much as do their symptoms and anatomical characters. In *lobar* pneumonitis, if seen at the commencement or within a few hours of the commencement, an emetic of ipecacuanha may be given as recommended by Trousseau. This acts promptly as a cardiac sedative, diminishing somewhat the afflux of blood towards the lungs, and moderating the inflammation. It should never be employed except at the period mentioned.

If the previous health of the patient has been good, his age above three years, and the attack is primary, and if the inflammation is, in part at least, in the first stage, acute or *venustum viride*, properly employed, is serviceable. Either one is an

efficient substitute for bloodletting. Some prefer aconite as less depressing than veratrum, and it is known to be a favorite remedy of homoeopaths. I have ordinarily employed the veratrum, prescribing the tincture in doses of one drop every three hours to a child of five years. It can be given dropped in sweetened water or in the syrup of tolu. Its effect should be carefully watched, and it should be omitted, or given less frequently, when the pulse is reduced to near the natural frequency. The pulse should be maintained two or three days, dating from the commencement of the attack, at about its natural frequency, but never below it.

If bronchial respiration, bronchophony, and dulness on percussion are present, indicating the second stage; in other words, if it appear from the signs that the inflamed lobe or lobes are hepatized, little benefit accrues from the use of so powerful a sedative, and much harm may be done. When this medicine is discontinued, or without its use, if the physician is not called till the stage of hepatization, a minute dose of tartrate of antimony and potash should be prescribed in the class of cases to which I allude. It may be advantageously combined with sulphate of morphia if the respiration is painful or cough troublesome. The following formula I have sometimes employed with a satisfactory result, for a child of five years:—

R.—Morph. sulph.,
Aniin. tart. ss gr. j;
Syr. tol. sat. ʒiv.
Misco.

Dose, one teaspoonful from two to four hours. In place of this mixture, Dover's powder, in combination with nitrate of potash, may be administered. There soon arrives a period when depressing remedies should be omitted. Many now recover with simple mucilaginous drinks or mild expectorants, like syrup of squills or ippecuanha in small doses. Others require more sustaining measures, and for such carbonate of ammonia with the syrup or decoction of senega is preferable.

The treatment described above is proper only for robust children with primary lobar pneumonia. In no other cases are measures so depressing required. There can be no doubt that the great error in the therapeutic management of children with this disease, has been the employment of medicines which reduced

the strength, when gentler measures, or those of a sustaining nature, were required. In secondary lobar pneumonitis or primary, if the patient is pallid, scrofulous, or at all wasted, or under the age of three years, neither *aconite*, *veratrum viride*, nor *antimony* should be given. Such cases require milder therapeutic agents, as syrup of squills or *ipocatantha* in the first stages, and, subsequently, carbonate of ammonia with *senega*. Some are best treated with ammonia and *senega* from the commencement.

The bowels should be kept open, as an important part of the treatment of lobar pneumonitis in its first stages. A small dose of castor oil, Rochelle salts, or citrate of magnesia should be given if there is any tendency to constipation, and repeated from time to time if required. A saline aperient by its derivative and refrigerant effect in some cases obviates the necessity of employing cardiac sedatives.

Local treatment is required in all cases; counter-irritation should be produced as soon as possible over the inflamed lobe, by mustard, iodine, or some stimulating liniment, and except at the time of this application, the chest should be constantly covered with an emollient poultice, or with a cloth wrung out of warm water and covered with oil silk. In a large proportion of cases, vesication is not required. If the inflammation is extensive, and the symptoms urgent, it is occasionally advisable to vesicate, and the cantharidal collodion should be used for this purpose. A safe, almost painless, and at the same time efficient mode of applying this is in spots as large as a ten-cent piece, half a dozen more or fewer according to the extent of the inflammation, leaving, of course, the skin sound between them. This mode of application obviates the danger of producing a troublesome sore, which sometimes occurs in children from the ordinary mode of vesication.

The diet in lobar pneumonitis should be nutritious, consisting of animal broths and the like, unless, during the first three or four days, in robust children.

In those few cases of acute lobar pneumonitis which occur in infancy, no remedy should be employed more depressing than *ipocatantha*, perhaps combined with some aperient like castor oil, as in the formula recommended in the treatment of bronchitis.

Before leaving the subject of the therapeutics of lobar pneu-

monitis, I desire to impress upon the reader the paramount importance of ascertaining fully, before he prescribes, not only the extent and stage of the inflammation, but especially the condition of the patient's constitution. For a large proportion of cases require sustaining measures from the first, and without a proper appreciation of the patient's state, the medicines ordered may be highly injurious instead of useful.

CIRCUMSCRIBED or LOBULAR pneumonitis, the pneumonitis of infancy, requires somewhat different treatment. In those exceptional instances in which this inflammation is primary and acute, the treatment should resemble that in acute lobar pneumonitis, the difference in treatment depending on the difference in age. But in the common form of circumscribed pneumonitis, which is a secondary disease, the measures employed should be sustaining from the first.

An important part of the treatment is moderate counter-irritation, produced especially in the scapular and infra-scapular region. A mustard poultice may be from time to time applied, or a turpenthinate or other stimulating liniment occasionally used. The chest should be enveloped with an oil-silk jacket, between which and the skin a cloth soaked with camphorated oil may be applied. The counter-irritation should be moderate and continual, and in some cases, after a single application of a more powerful counter-irritant, as the mustard, the camphorated oil properly covered with the oil-silk suffices. If the breathing is oppressed and painful, a poultice may be applied over the chest under the oil-silk. If there is reason to think that the pneumonia is due to, or is increased by hypostatic congestion, frequent change of position is advisable.

For this form of pneumonitis, syrup of senega and carbonate of ammonia are better adapted than any other medicine. They can be given in combination as directed in the treatment of bronchitis. They are especially serviceable if there is accompanying bronchial inflammation. Nutritious diet, and often alcoholic stimulants are needed.

CHAPTER VI.

PLEURITIS.

PLEURITIS or pleurisy is a primary or secondary disease. The primary form is rare in infancy, while the secondary is not infrequent. In children statistics show that the primary is more common than the secondary. Billiet and Barthez state that they have met three cases of primary pleurisy occurring under the age of five years, and twenty-three between that age and the age of fifteen years. Of secondary pleurisy they met five cases under the age of five years, and nine between that age and ten years. The post-mortem examinations which I have witnessed of cases of pleurisy have been mostly under the age of five years, and in these the secondary form has greatly preponderated. At the autopsies in the Nursery and Child's Hospital, and in the Children's Service in Charity Hospital, we not unfrequently meet cases in which the pleuritis appears at first to be primary, but on more careful examination, it is rare that we do not find some antecedent pathological state which gave rise to it.

CAUSES.—The ordinary cause of primary pleuritis is the same as that of most primary inflammations, namely, the impression of cold. It is therefore most common in the cold months, and in times of changeable temperature. It is most common among those children who are much exposed to vicissitudes of the weather.

The causes of secondary pleuritis are quite numerous. The most common, after the age of three years, are tubercles, pneumonia, and scarlet fever. Tubercles cause pleuritis by their irritating effect upon the pleura, and of course only those tubercles can produce this result which are seated directly underneath this membrane. Pneumocitis causes pleurisy by extension of the inflammation. Scarlet fever gives rise to it indirectly as a sequel. In a certain proportion of cases of this exanthem during the period of desquamation or convalescence, active congestion or

inflammation of the kidneys occurs, giving rise to uræmia. Urea in the blood is an irritant to serous structures, and hæmæ is a not infrequent cause of pleuritis.

In the infant many cases of pleuritis are due to the escape or discharge into the pleural cavity of some pathological product, usually pus, softened tubercle, or decomposed lung tissue. This substance is an irritant, and it produces acute and often general pleuritis. A very small amount of pus or softened tubercle, or of decomposed lung escaping into the pleural cavity, gives rise to violent and fatal pleurisy.

A retro-pharyngeal abscess in rare instances descends behind the pharynx and œsophagus, and opens into one of the pleural cavities, causing fatal pleuritis. A suppurated bronchial gland, or an abscess into the walls of the chest, occasionally produces the same result. In January, 1864, I presented to the New York Pathological Society the lungs of an infant with the following history: R., nine months old, of German parentage, family scrofulous. Its own health was good prior to the sickness of which it died, and it was fleshy. The only other child in the family, a girl, had suffered from strumous ophthalmia and strumous periostitis of the tibia. This infant was taken sick about December 19th, 1863, with moderate febrile movement and restlessness, but apparently without any serious indisposition. On the 22d of December, the mother called my attention to a prominence just below the right clavicle. This proved to be an abscess. A poultice was applied in the expectation that it would discharge externally. On the 24th of December, however, the prominence subsided, and immediately the symptoms were greatly aggravated. The pulse rose to 160 per minute, the respiration to 60 or 80, and expiration was accompanied by a moan so common in acute inflammation of the pleura or lung. Within a day or two after the disappearance of the tumor, and the exacerbation of the symptoms, dulness on percussion was observed on this side, and this increased till there was perfect flatness. The right pleural cavity had evidently filled with liquid, the acceleration of pulse and respiration continued, the patient grew more and more feeble, and death occurred December 31st.

At the autopsy on dissecting away the integument from the right side of the chest, an abscess was opened containing nearly an ounce of pus, located at the point where the tumor had been

observed. There was a small round opening from this abscess directly into the cavity of the chest, so that on depressing the ribs, liquid escaped from the cavity. On removing the sternum, the liquid was found to consist mainly of serum with lymph, and at the bottom of the liquid was considerable pus. I have met one other case, apparently almost identical with this, the infant being seven months old, but I did not attend it in the latter part of its sickness. The abscess in the case which I have detailed was obviously strenuous, probably occurring from glandular inflammation. This mode of production of pleuritis, namely, by the discharge of an abscess located in the thoracic walls is no doubt rare. It was so considered by the members of the Pathological Society. Pleuritis is not common in the circumscribed or lobular pneumonia of infants, but it sometimes occurs in the following manner: Little abscesses are produced in the solidified lung containing from one or two, to as many as fifteen or twenty drops of pus, as has been stated in our remarks on pneumonia. The pus approaching the pleural surface produces circumscribed pleuritis at that point, or opening into the pleural cavity, it gives rise to general pleuritis, with or without pneumothorax. The following cases, among others which I could present, established this point. These cases are also interesting, as showing the occasional latency of pneumonitis.

CASE I.—I. M.—, male infant, was admitted into the Nursery and Child's Hospital, May 17th, 1859, at the age of two months. He was very delicate at the time of admission, and had slight leucæmia, but being placed with a wet-nurse, he gradually improved. About the middle of July, attacks of diarrhoea occurred, each lasting from one to two days, and from this time his health declined. Fervid eruptions appeared on the head and neck, and though sustaining measures were employed with medicines to control the diarrhoea, there was progressively more emaciation and feebleness.

The records on August 1st state, "Continues to fail, apparently from the attacks of diarrhoea; the febrile eruption continues." On the 3d of August, he died suddenly of apnoea, though there had been no symptoms to direct attention to the chest. Possibly he had a slight cough which had escaped detection.

Autopsy eight hours after death.—Stomach and jejunum healthy; mucous membrane lining the lower part of the ileum, and the entire colon vascular, and that of the colon considerably thickened; mesenteric glands enlarged, and of a lighter color than in health; right lung compressed by a sero-fibrinous exudation, so as to occupy a small space, though the amount of liquid was not more than two ounces; nearly the entire pleura, visceral and parietal on this side, was covered

with a fibrinous deposit of a creamy appearance. Some of this had settled in the depending portion of the cavity. This lung could be inflated, except a little of the lower lobe, which was hepatized.

On the left side the lung also occupied a very small space, being collapsed; the upper lobe could be readily inflated when it had the elasticity of healthy lung; the lower lobe had a healthy appearance, and could be inflated, except a portion in the posterior aspect, measuring, perhaps, an inch in diameter; this was partially coated with lymph, and was found to contain two small abscesses, one closed, the other opening externally on the surface of the lung, and laterally into a bronchial tube. On attempting inflation, the air passed directly through this opening. The closed abscess contained from one-third to half a drachm of pus corpuscles, and disintegrated lung tissue, as shown by the microscope. This child was much emaciated.

Case 2.—**M. I.**—, female, was admitted into the Child's Hospital October 5th, 1859, at the age of about four months; at the time of admission, was somewhat wasted with diarrhoea; her health improved partially, but she remained feeble, and was at times much troubled with meteorism which occasioned pain.

On the 2d of November, she was suddenly seized with great dyspnoea, which terminated fatally in about a quarter of an hour. Previously to the dyspnoea, no cough had been noticed, or other symptoms referable to the chest.

Autopsy.—Body considerably emaciated; left lung healthy, with the exception of slight hypostatic congestion; right lung adherent to the diaphragm, and to a considerable part of the costal pleura by fibrinous exudation; this lung was somewhat compressed and non-crepitant; the upper lobe floated in water; the middle and lower sank and could not be inflated, or but slightly; this portion of the lung contained a few small abscesses, filled with purulent matter, each holding scarcely more than one drop; two of these seemed to have discharged into the pleural cavity, as the air passed through them in attempting to inflate, but possibly they may have been opened in separating the adhesions which united the two pleural surfaces at this point; two or three ounces of fluid were contained in the pleural cavity, consisting, in addition to serum, of fibrinous foci, epithelial cells from the pleura, pus cells, and compound granular cells; the lower portion of this fluid, on standing, contained so much pus that it presented the characteristic gelatinous appearance on the addition of liquor potassæ; the other organs generally were normal in appearance, but the liver was somewhat congested, and there was also decided hyperæmia of the mucous membrane of the colon near the ileo-cæcal valve, and in the descending portion.

In cases like the above, the pleuritis is obviously due either to the escape of pus from the lung into the pleural cavity, or to its near approach to the pleura. In the former case the inflammation is apt to be general; in the latter circumscribed. The above cases are interesting, as showing an occasional result of circumscribed pneumonia, namely, hydrothorax in addition to the pleuritis.

Occasionally, in the infant, the cause of the pleuritis is not apparent. In some such cases the inflammation is probably secondary, while in others it is primary.

At the autopsy of an infant who died at the age of about one month in the Infant's Service of Charity Hospital, in 1867, a small amount of pus, not more than a drachm, was found in one pleural cavity, and less than this quantity in the other. On both sides there was nearly general injection of both the visceral and costal pleurae, but without exudation of serum or fibrin. There was pus also at the roots of the lungs, extending somewhat over the lungs, but under the pleura. The source of the pus was not apparent, but the most reasonable supposition was that it came from a suppurated bronchial gland, and had produced the pleuritis, which was still in the first stage, or that of engorgement of the vessels, when the infant died.

The comparative frequency of pleuritis in foundlings and in feeble and cachectic infants, shows that feebleness of constitution and anti-hygienic conditions constitute a strong predisposing cause to this disease in infancy. From the above facts it is obvious that pleuritis and pneumonitis, occurring in early life, are similar as regards their causation. Both are ordinarily secondary in infancy, while in childhood their occurrence as primary diseases is not uncommon.

ANATOMICAL CHARACTERS.—The first appreciable structural change which occurs in pleuritis is engorgement of the vessels lying underneath the pleura. There can be seen, if an opportunity is presented, as in the case detailed above, a network of engorged capillaries. Immediately exudation commences into the connective tissue surrounding the capillaries, the pleura becomes opaque, and liquor sanguinis escapes on its free surface. The amount of serum and fibrin which are exuded into the pleural cavity varies greatly in different cases, as do their relative proportion.

In pleuritis due to the irritation of tubercles, or to extension of inflammation from an inflamed lung to the pleura which covers it, the amount of serum is ordinarily small, and occasionally almost entirely absent, so that the visceral and costal surfaces remain in contact. In other cases, namely, when the pleuritis is idiopathic, or due to uræmia, or to a foreign substance in the pleural cavity, the amount of serous effusion is considerable, producing more or less compression of the lung. The most frequent

exceptions to these general statements, I have observed in the pleurisy of tuberculous in infants, in which form of the disease the lung is not unfrequently somewhat compressed by the liquid.

Ordinarily the fibrin forms a layer over the inflamed pleura, at first soft and readily detached, but gradually becoming firmer. The serum also contains fibrinous flocculi. The subpleural vessels are prolonged into the exudation, and a vitalized pseudo-membrane and bands of adhesion are in time produced.

Pleuritis, except when due to a local cause seated beneath the pleura, as tubercle or pneumonia, extends rapidly, becoming in a little time nearly or quite general.

In a certain proportion of cases empyema occurs in the child as in the adult. It has seemed to me that in foundlings, and ill-conditioned children, there is greater tendency to suppurative pleuritis than in the more robust. In my experience, pleuritis has been more frequently suppurative in children than in adults.

Pleuritis has, for convenience of description, been divided into three stages; the first, extending from the commencement of the inflammation to the time when there is an appreciable amount of exudation; the second, from the time that the exudation is appreciable to the commencement of absorption; the third stage is that of absorption or convalescence. Absorption commences when the inflammation abates, and the rapidity with which the fluid disappears varies greatly in different cases. As absorption occurs, the compressed lung gradually expands to occupy the place of the fluid. Sometimes absorption occurs more rapidly than the expansion, so that there is contraction for a time of the affected side, which gradually disappears. The serum is first absorbed, and then more or less of the fibrin undergoes fatty degeneration and liquefaction, and is then absorbed. Commonly, as the serum is absorbed the two pleural surfaces become permanently adherent, and the lobes are likewise permanently united to each other by fibrin.

In rare instances, in which there is a large amount of serous exudation, producing complete carnification of the lung, and the layer of fibrin which invests this organ is dense and unyielding, inflation never occurs, and the ribs of the affected side are permanently depressed. Respiration henceforth is performed entirely by the other lung, which increases somewhat in volume by greater dilation of its air cells. The compressed lung remains

non-crepitant and firm, and its color somewhat lighter than the natural hue, from defective supply of blood and granular change in the anatomical elements of the lung.

In empyema, absorption obviously cannot occur unless the quantity of pus is small. Empyema, therefore, except when relieved by paracentesis, is a lingering disease, attended by many of the symptoms of tuberculosis. Spontaneous cure occasionally occurs, by discharge of pus into a bronchial tube, or externally through the walls of the chest. I have witnessed both these modes of termination. In rare instances, pleuritis on the left side becomes complicated with pericarditis, and, more rarely, pleuritis in the lower part of the right pleural cavity, with perihepatitis. The former complication occurred in an infant eight months old, in the infant service of Charity Hospital, and the latter in a still younger infant in the same institution.

SYMPTOMS.—Occasionally, as in cases related above, pleuritis is latent. This may be its character, both in the primary and secondary form. Latency is more frequent in infancy than childhood.

As circumscribed pleurisy is for the most part a secondary disease, the symptoms which are present are due partly to it and partly to the primary affection. Obviously the symptoms vary in different cases, according to the presence or absence of other diseases, the age and robustness of the patient, and the extent of the inflammation. In most cases the commencement of pleuritis is indicated by increase in the frequency of the pulse and respiration, the expiratory murmur, and sometimes by tenderness on percussion over the seat of the inflammation. There is a short cough, dry or hacking, unless bronchitis coexists, in which case there is more or less expectoration; at the same time, those symptoms are present which are common in all inflammatory affections, such as anorexia, thirst, and increase of temperature. The symptoms enumerated, though commonly so severe as to draw attention at once to the chest, are in other cases so mild, even when the inflammation is not latent, that they may be at first overlooked. There is, indeed, every gradation between severe symptoms and latency.

In acute general pleuritis the symptoms are commonly severe. The pulse rises to 120 or 140 beats per minute, and in young children it may be more frequent; the respiration is increased in

a corresponding degree; the face is flushed and indicative of suffering; the patient is restless, complaining, if old enough to speak, of the stitch-like pain in the chest, which is most intense on inspiration and in coughing.

When exudation occurs the symptoms abate partially. The pulse and respiration are less frequent, though still accelerated, and the latter is less painful. Convalescence is more protracted in pleuritis than in pneumonitis. Several weeks frequently elapse before the liquid is fully absorbed, during which time there is more or less acceleration of pulse. The appetite and strength return gradually.

In suppurative pleuritis or empyema, the symptoms may not differ materially at first from those in the ordinary form of inflammation, but absorption does not occur, or there is but a slight degree of it, limited to a portion of the liquor puris. The pus produces the ordinary effects of purulent collections in the system, namely, loss of appetite, hectic fever, emaciation, loss of strength. No improvement occurs except by discharge of pus, when restoration to health is often rapid. In fatal cases of empyema the vital powers gradually yield, the pulse becomes more frequent and feeble, the face and limbs pale and cool, and death occurs from asthenia.

PHYSICAL SIGNS.—The physical signs vary according to the extent of the inflammation, and the amount of exudation. The friction sound is seldom observed in the infant, and it is less frequently observed in the child than in the adult.

Percussion in the commencement of pleuritis before there is any appreciable exudation gives a negative result. If dulness is observed, it is due to coexisting disease, commonly pneumonitis or tuberculosis. In those cases in which no effusion of serum occurs, or in dry pleurisy, as it is termed, percussion at all periods of the disease gives only negative information. This is the case in a large proportion of circumscribed pleuritis.

If there is serous effusion, and this occurs in most pleuritic attacks, which are not dependent on pulmonary disease, and some in which there is this dependence, percussion over the liquid elicits a flat sound, while the resonance above the level of the liquid is good, and occasionally even tympanitic. Flatness on percussion distinguishes pleuritic effusion from simple pneumonia, since in pneumonia percussion produces a dull, but not flat sound. In

the infant in whom pneumoemia is circumscribed, the difference is very marked. Change in the height of the flatness, according to the position of the patient, is observed in infancy and childhood, not less than in adult life.

When the second stage commences, and the pleural cavity contains more or less liquid, the respiratory sound sometimes disappears from the part of the chest which is occupied by the liquid, but in a large proportion of cases in childhood, and usually in infancy, in which period the pleural cavity is small, respiration is heard when the ear is applied over the liquid. It is bronchial, and is transmitted from a distance through the liquid.

This physical sign may disappear in two or three days, or remain during the whole period of exudation. It varies in the extent of surface over which it is heard, and in its intensity, according to the amount of the liquid and the strength and rapidity of the respiration. It sometimes, according to Rilliet and Barthéz, partakes of the cavernous respiratory sound, so that in the first case in which they observed this modification, their diagnosis was erroneous. There was complete restoration to health, with absorption of the fluid, although they had diagnosed a cavity.

If there is a large amount of fluid and the lung is compressed at the top of the pleural cavity, bronchial respiration may be heard above the level of the fluid, in the infra-clavicular region. In the adult this is a common physical sign. Egophony is occasionally observed in acute cases, in which there is a rapid and large effusion. It is heard in the infra- and inter-scapular spaces. Its duration is commonly brief, disappearing in three or four days or even in less time. In the child as in the adult, if there is much liquid in the pleural cavity, there is bulging of the intercostal spaces on the affected side, and distension of the walls of the chest. In young children the physical signs, unless carefully examined and considered, are apt to convey a wrong impression, as regards the state of the lung, and pleural cavity. The following case exemplifies this fact. It is not improbable that thoracostomy would have relieved the anasarca and saved the life of the patient.

CASE.—H—, boy, four years, four months old, was taken with scarlet fever in the latter part of May, 1865. The disease was severe, and was attended with glandular and cellular inflammation of the neck, with suppuration on both sides. Purulent discharge from the abscesses continued through the month of June. The patient was

gradually conglobating, when about July 4th, pleuritis commenced on the left side, attended by the ordinary symptoms of acute forms of this inflammation. A few days subsequently, the pleural cavity was ascertained by physical examination to be about half full of liquid.

Towards the close of July, anasarca commenced about the ankles and gradually extended upwards. It was limited to the lower extremities, and to the abdominal walls, and by the middle of August became excessive. The thoracic walls and the upper extremities were somewhat emaciated, and the face was pallid and anxious.

On the 7th of August, a careful examination of the chest was made in reference to the propriety of thoracentesis. The inter-costal spaces on the left side were not prominent, but rather depressed. Percussion over the lower third of the left pleural cavity elicited a flat sound, while above this the resonance was tympanitic. On account of the great restlessness of the patient, no useful information was derived from change of position. On auscultation distinct bronchial respiration was heard over nearly or quite the entire left side of the chest. The apex beat of the heart was on the right of the sternum. It was my opinion, as well as that of two other physicians, that the liquid was in process of absorption, and that the quantity present was not large. Thoracentesis did not, therefore, seem a proper measure.

The anasarca still limited to the lower extremities, and the abdominal walls continued to increase, and on the 25th of August, so great was the distension, that the skin broke in one or two places above the ankles. The mind remained clear, and the appetite was pretty good. Death occurred August 27th.

Section Cadaver.—Head not examined; abdominal and right pleural cavities contained no effusion, and were in their normal state, except that the latter cavity was somewhat encroached upon by the heart and mediastinum; a great amount of oedema in the lower extremities and in the abdominal walls; abdominal walls towards the spine about three inches thick in consequence of oedema; right lung of good size and presenting the ordinary appearance, except a greater amount than usual of hypostatic congestion; about three pints of pus (handful) in the left pleural cavity; left lung completely encased and lying against the vertebral column; its size about that of an orange, and its surface covered with a dense layer of fibrin; heart displaced, as already stated, to the right, and a little downward, so as to compress, and partially obstruct the circulation in the ascending vein cava; this vessel contained a continuous firm and yellow fibrinous clot, nearly filling its calibre; the femoral vein, examined on one side, was found to contain soft and dark clots. Compression of the cava opposite the heart and the formation of clots had evidently given rise to the anasarca.

DIAGNOSIS.—The diagnosis of pleuritis is in some cases readily made; in other cases it is difficult. It is most difficult in circumscribed pleuritis, in which there is little effusion. It may in such cases, be sometimes diagnosed by observing the friction sound, by tenderness on percussion over the seat of the inflam-

tion, and by the symptoms, such as hurried and painful respiration, the expiratory moan, and great acceleration of pulse. Circumscribed pleurisy, when latent, is often overlooked. It is detected with difficulty even with careful examination of the chest.

On the other hand, pleuritis with effusion of liquid into the pleural cavity is easily diagnosed in most instances. It might be mistaken for hydrothorax, or *etc versa*; but the history of the two affections affords reliable means for differential diagnosis. Hydrothorax in the child commonly results from one of the eruptive fevers, especially scarlatina, and its immediate cause is nephritic congestion or inflammation, or heart disease. Rarely it is due to obstruction in the pulmonary circulation, in consequence of enlarged tubercular bronchial glands. It is not, therefore, preceded or accompanied by symptoms of inflammation referable to the chest, such as are present in pleuritis with effusion.

The diagnosis from solidified lung, whether tubercular or inflammatory, may be made by attending to the physical signs, which have been already in part stated. The signs which are peculiar to pleuritic effusion, and are therefore of diagnostic value, are evidences of change in the height of the fluid, by change in the position of the body, bulging of the intercostal spaces, and of the walls of the chest in consequence of the fluid, retraction of the chest as the fluid is absorbed, no vibration of the walls of the chest, when the patient speaks, and no bronchophony, or but slight.

Prognosis.—Primary pleuritis, occurring in patients previously healthy, commonly ends favorably; but it is a serious disease if the general health has been much impaired. The prognosis is more favorable if, as is commonly the case with this form of pleurisy, the patient is over the age of three or four years.

Secondary pleuritis is, on the other hand, a grave affection, but the prognosis depends greatly on the character of the primary disease, and also on the age. Pleurisy resulting from and coexisting with pneumonitis, commonly ends favorably even in quite young patients. Pleuritis arising from scarlet fever is a serious complication or sequel, but a considerable proportion affected with it recover under judicious treatment. The prognosis in tubercular pleuritis and pleuritis occurring from the escape of pus into the pleural cavity is obviously unfavorable.

Tubercular pleuritis may be temporarily relieved, but it is apt to return. Suppurative pleuritis, or empyema, is also an unfavorable form of inflammation, characterized by the chronicity and many of the symptoms of tuberculosis. It is in time fatal unless the pus is evacuated. On the escape of the pus there is usually progressive and complete restoration to health.

TREATMENT.—The indications of treatment are, in the commencement of the inflammation to diminish its intensity, and relieve pain; at a later period, to promote absorption and sustain the vital powers.

Pleuritis is one of the few inflammations in early life in which the abstraction of blood may be proper. It may be stated as a rule, that loss of blood is not only not required, but is an injudicious measure in all secondary pleuritis, and in the primary form after exudation into the pleural cavity has occurred. It is a useful measure at the commencement of acute primary pleuritis occurring in a robust state of system. One or two leeches should be applied directly over the seat of the inflammation, and bleeding may be encouraged for two or three hours subsequently by the application of cloths wrung out of warm water. Unfortunately the physician is, in many cases, not called at this early period; or if called, he fails to make the diagnosis till there are evidences of exudation.

After the bleeding has ceased, or in subacute and secondary pleuritis without the employment of leeches, rubefacient applications should be made over the affected side of the chest, followed by a poultice, or flannel wrung out of warm water, and covered with oil-silk. Moderate counter-irritation diminishes the pain, but vesication at this early period is injurious. A blister applied so near the seat of the inflammation may increase the afflux of blood towards it, and aggravate the disease.

Robust patients over the age of three or four years are benefited by the use of cardiac sedatives in the commencement of acute pleuritis. The tincture of acconite, or of *veratrum viride*, may be given, but its effects should be carefully watched, and it should be discontinued when the pulse is reduced to near the natural frequency, or when sufficient exudation has occurred to produce the ordinary physical signs of liquid in the chest. They should not be given in secondary pleuritis.

Opiates are required, as in other serious inflammations, accord-

ing to the pain. Dover's powder, in doses of one to three grains, according to the age, may be given every three hours, or less frequently if the patient is inclined to sleep.

Such is the treatment required in the first stage of acute primary pleuritis, or that preceding the effusion. Secondary pleuritis requires fewer and less depressing measures. The appropriate treatment, in a large proportion of the cases of this form of the disease, consists in the use of an opiate with rubefacient and emollient applications to the chest. Abstraction of blood, and powerful cardiac sedatives, as acnute and veratrum viride, are dangerous remedies in secondary pleuritis, and are almost never used.

Pleurisies dependent on pulmonary disease, which are circumscribed and attended with little serous effusion, require no other therapeutic measures than those already mentioned. The judicious use of opiates, and rubefacient and emollient applications, suffice for their treatment.

In the treatment of other forms of pleurisy, which are attended by more or less effusion of liquid into the pleural cavity, measures designed to remove this liquid are required when the inflammation has abated, and antiphlogistics are no longer appropriate.

Liquids in the great cavities are best eliminated by hydragogue cathartics and by diuretics. For children, however, already weakened by pleuritic inflammation, cathartics are usually too depressing unless for one or two days. Now and then a robust patient, over the age of five or six years, with pleuritic effusion, may be benefited by an occasional purgative dose of bitartrate of potassa, or by from one-twelfth to one-sixth of a grain of podophyllin. But such cases are exceptional. In a majority of children the loss of strength resulting from cathartics more than counterbalances the good result from the liquid evacuations which they produce.

Diuretics, on the other hand, are efficient remedies, and upon them our chief reliance must be placed.

The diuretic from which I have seen better effects than from any other, is iodide of potassium, but it should be given in large doses. In the adult I have observed rapid absorption of the liquid by the administration of from one to two drachms daily of this agent, given in doses of ten grains, and a child can take a proportionate dose. Two to five grains, according to the age,

may be given every three hours. At the same time it is advisable to restrict the drinks.

At this stage of the disease counter-irritation is appropriate, either by rubefacients or vesicants. The preferable mode of blistering the child is, in my opinion, by cantharidal collodion applied as recommended in the treatment of pneumonia.

In secondary pleuritis the diet should be nutritious, consisting largely of animal broths, through the whole period of the disease.

In primary pleuritis nutritious diet should be allowed after exudation has occurred. In some cases, more frequently in secondary than primary pleuritis, stimulants are required. In protracted pleurisy, or pleurisy occurring in a debilitated patient, tonics, both vegetable and chalybeate, are often serviceable, sustaining the strength while the process of absorption is going on.

Occasionally, the measures which have been recommended above to promote absorption of the liquid in the pleural cavity, do not have the effect which is desired. If there is no sensible diminution in its amount, and if the general health of the patient begins to fall, the performance of thoracentesis should be considered. We may accomplish by surgery what we fail to effect by therapeutic means. The following remarks by Prof. Flint, on this subject, are instructive. They apply to thoracentesis in children as well as adults. (*Flint's Practice of Medicine*, 2d ed., p. 165.)

"Heretofore this operation was performed only as a *drain* *viæ*, under circumstances when little was to be expected from any measure. It was deferred as long as possible, sometimes on account of doubt as to the diagnosis, and because the perforation and introduction of air were supposed to involve danger of an increase of the inflammation. A considerable opening was necessary in order to give free exit to the liquid, and it was not easy to prevent the air from entering the pleural cavity. Objection to the operation on the score of diagnosis is now removed by our present knowledge of physical signs. Moreover, the operation has been divested of all severity, and the liability to the introduction of air has been provided against by the application of the suction pump, first suggested by Dr. Mead Wyman, in 1859; and since employed in a large number of cases by Dr. Bowditch. The introduction of air is not attended by the injurious effects formerly apprehended, but it is objectionable because the presence of air is an obstacle to the full expansion of the lung after

the liquid is removed. Its introduction is prevented by the use of the pump in withdrawing the liquid. The operation is rendered trivial because with the suction force of the pump a small exploring trocar suffices to make the puncture, which causes very little pain, and closes directly the canula is removed."

Dr. Bowditch had performed the operation one hundred and fifty times on seventy-five individuals prior to 1843, in the manner described above, and in twenty-nine of the patients recovery was apparently due to it. Prof. Flint has several times successfully performed the operation, using a small trocar and canula made to screw on the flexible suction tube of Davidson's syringe.

M. Guersant describes his mode of performing thoracentesis, in the *Bull. Génér. de Thérap.*, Oct. 15, 1864. He generally "plunges in the instrument above the superior border of the tenth rib on the left side, and the eighth rib on the right, and at the junction of the posterior one-third with the anterior two-thirds of the intercostal space. He employs a trocar about two lines in diameter, and nearly two inches in length, curved like a tracheotomy canula and furnished with a flap of membrane over its external orifice. The child is placed upon its back, and firmly held, while the operator with his left hand draws upon the skin, and with his right inserts the trocar, with its concavity looking downwards as as to avoid injuring the lung. The membrane at the external orifice of the canula, being previously moistened, excludes the entrance of air. On withdrawing the instrument, the skin passes over the wound, and the parts unite by first intention, provided that the liquid is sero-fibrinous."

In case of empyema, if the opening is allowed to heal immediately, subsequent tappings are requisite. Some surgeons, especially if they desire to make injections into the pleural cavity, allow the canula to remain. M. Guersant prefers to insert a vulcanized caoutchouc tube in these cases small enough to pass through the canula, which is then withdrawn. A piece of gold-beater's skin is loosely tied over the external orifice, so as to receive the pus as it flows through the tube. Injections of tincture of iodine much diluted, of chlorinated water, etc., may be made through the tube in order to produce a more healthy state of the pleura, or the pleural cavity may be washed by tepid water. Care is necessary in order that the tube be of proper length, for if too short, it does not reach the liquid, or if too long, it irritates the lung.

SECTION III.

DISEASES OF THE DIGESTIVE APPARATUS.

CHAPTER I.

SIMPLE STOMATITIS; ULCEROUS STOMATITIS;
FOLLICULAR STOMATITIS.

DISEASES of the digestive system in infancy and childhood are of frequent occurrence. They are for the most part readily recognised, and are more easily and quickly controlled by therapeutic agents, if rightly applied, than are the diseases of any other system. If misunderstood and improperly treated, they may, even when mild, and very manageable in their commencement, become chronic and obstinate, or even fatal, or they may lead to other and more dangerous diseases. It is necessary, then, that the physician should understand thoroughly the diseases of the digestive system in infancy and childhood, that he may make timely and correct use of the required remedies.

The diseases of the buccal cavity in early life are for the most part inflammatory. The mildest is that known as—

Simple or Erythematic Stomatitis.

This form of inflammation occurs usually before the completion of first dentition, and it is most frequent under the age of one year. Giving rise in itself to no severe symptoms, and often being connected with other grave and dangerous affections, it is, doubtless, in many cases overlooked. It is sometimes confined to a portion of the buccal surface, or is more intense in one part than in another. In other cases the stomatitis is uniform, or nearly so, affecting the entire mouth.

CAUSES.—The common cause of simple stomatitis in infants is the same as that of most cases of gastro-intestinal inflammation at that age. This is the use of indigestible and therefore irritating food, uncleanness, personal and domestic; in fine, all those agencies which impair the general health, and enfeeble the digestive organs. Therefore stomatitis, like entero-colitis, is more common in the city than in the country, and among the city poor than those in the better walks of life. Foundlings deprived of the mother's milk and given a diet which, with all care of preparation, is a poor substitute for the natural aliment, are very liable to this disease. Stomatitis has also sometimes been attributed to the local effect of certain substances taken in the mouth, as of drinks too hot. This disease is also present in measles and scarlet fever. It then corresponds with the cutaneous eruption, and disappears when that subsides.

Another cause is dentition. The gum over the advancing tooth first becomes inflamed, and other causes perhaps conspiring, the inflammation extends over more or less of the buccal surface. When due to dentition the stomatitis is more apt to be partial than when it arises from a constitutional cause.

SYMPTOMS, APPEARANCES.—Stomatitis, like other mucous inflammations, is characterized by increased redness and more or less thickening of the inflamed buccal membrane, by rapid proliferation and exfoliation of epithelial cells, and by an increased functional activity of the muciparous follicles. The heat of the mouth is sometimes augmented in an appreciable degree. The gums in severe cases are swollen and spongy, and bleed easily if rubbed or pressed. The tongue is usually covered with a light fur, and the salivary secretion is augmented. The child is fretful unless in mild cases, and sometimes gives evidence of pain in taking food, especially that of a solid nature.

Simple stomatitis is not difficult of detection, provided attention is directed to the mouth. Inspection informs us of its presence and extent. A favorable termination may be confidently predicted, unless there is a state of marked cachexia, or a grave coexisting disease. If circumstances are unfavorable, simple stomatitis may terminate in a more severe form, as the ulcerous or diphtheritic.

TREATMENT.—Sometimes no special treatment is required, as in measles or scarlet fever. When the primary affection termi-

nates, the stomatitis disappears of itself. If dentition is the cause, and there is much fever and fretfulness, it may be advisable to scarify over the advancing tooth, and employ such soothing and derivative measures as are required in painful dentition. In these cases mucilaginous and mild astringent lotions may be employed. Borax is a good remedy used either with honey or water; one part of borax to three of honey, or a scruple of borax to an ounce of water. A weak solution of alum is also a good topical remedy. With either of these remedies in a good condition of system, and without any serious coexisting disease, the stomatitis is relieved.

Ulcerous Stomatitis.

In this affection, in addition to redness, swelling, softening, and augmented heat of the buccal mucous membrane, there are ulcers covered with a pseudo-membrane. Its *essential characters* are then those of severe simple stomatitis with the additional lesion, which gives it its distinctive name. The ulcers commence, according to M. Taupin, as small white or light yellow points, which consist of a plastic exudation under the epithellum. This exudation gives rise to ulceration of the mucous membrane lying over it. Hence the name *ultero-membranous stomatitis*, applied to this disease by Rilliet and Barthez.

The inflammation usually begins upon the gums and extends along the buccal surface. Wherever it commences, there soon appear little white points underneath the mucous membrane producing slight prominence of it. These points, which are fibrinous, and are the product of the inflammation, gradually enlarge. Some unite and give rise to large irregular ulcerations; others remain isolated, producing smaller and more regular ulcers. There is, indeed, no uniformity as regards the size and shape of the ulcers. In the folds of the buccal membrane they are apt to be elongated, while inside the lips, or where the surface is smooth, the circular or oval form predominates.

Ulcerous stomatitis is usually confined to that part of the buccal surface which covers the gum, or is in their immediate vicinity, but in rare cases it affects a considerable part of the mouth.

If the disease is severe, there is considerable swelling around the ulcers, but the swollen part is soft and cushiony, and not very

tender on pressure. The soft and yielding nature of the swelling serves as a means of diagnosis, between this disease and the promontory stage of gangrene; since in the latter affection the swollen part is more indurated.

If the disease grows worse, more ulcers appear; the plastic exudation if detached is renewed or it becomes thicker by the formation of new layers. The ulcers grow deeper and wider and their edges more vascular.

If, on the other hand, there is improvement, the swelling subsides, the ulcers become more clean, their bases approach the level of the mucous membrane and present a granulating appearance. Finally the mucous membrane is reproduced. A considerable time after the ulcers are healed, the new membrane which occupies their site has a redder hue than the adjacent surface.

CAUSES.—Ulcerous, like simple stomatitis, is most frequent in the families of the poor. Personal uncleanness, poor food, living in apartments dirty, humid, or in other respects insalubrious, favor its development. In fine, a cachectic condition, however produced, is a common predisposing cause. It frequently occurs when the system is reduced or enfeebled by acute diseases, as after the essential fevers and thoracic and intestinal inflammations. In protracted enterocolitis of infants, it is sometimes severe and obstinate, and a case in which this complication arises usually ends unfavorably.

Occasionally several cases occur together or consecutively in the wards of a hospital, and this has led some observers to believe that ulcerous stomatitis is contagious. But its prevalence under such circumstances is attributable to the fact that there is a common exposure to the influences which give rise to the disease, just as a whole household exposed to malaria may be seized with intermittent fever. Difficult dentition is also an occasional cause.

SYMPTOMS.—The symptoms in ulcerous stomatitis are more severe than in the simple form. There is more fever, more salivation, and more fretfulness. The ulcerated surface is sometimes very tender, so that there is but little sleep. Drinks, unless bland and lukewarm, are painful, and if the ulcers are on the lips or the front of the mouth, the infant nurses less eagerly than usual, and even with reluctance. In these cases it sometimes weans itself. Occasionally the submaxillary glands are tumefied,

hard, and tender. The breath has an offensive odor. In mild cases in which the stomatitis is of limited extent, this odor may scarcely be noticed, but in severe cases it is almost like that exhaled from putrid substances.

PROGNOSIS.—A favorable prognosis may be given unless the patient is in a decidedly cachectic condition, or there is a serious coexisting disease. Under such circumstances it may be protracted. If death occur, it is due to the cachexia or to some pathological state quite distinct from the stomatitis. Ulcerous stomatitis, when the ulcers are small and the inflammation of limited extent, is of course more easily cured than when it is extensive, and the ulcers are large.

This disease is very liable to return, unless the general health is good.

TREATMENT.—The physician should endeavor to ascertain the cause of the stomatitis, and so far as possible to remove the patient from its influence. It is often necessary, in order to insure a speedy recovery, to recommend a change in regimen, especially as regards diet and cleanliness. If the patient live in damp, dark, and dirty apartments, the family should seek a better residence, and he should be taken daily in the open air.

Tonic remedies are generally required. The ferruginous preparations may be advantageously given, or the vegetable tonics, or the two in combination. In selecting the internal remedies we must regard the antecedent disease, if there be any, which the buccal inflammation complicates, and on which it depends. For local treatment Trousseau recommends occasional applications of nitrate of silver or muriatic acid as a caustic, and in the intervals a wash of equal parts of borax and honey.

The chloride of lime is also considerably used in Paris. It is recommended by Billiet and Barthez. It is applied dry to the ulcerated surface twice daily, and in the interval the mouth is washed with simple water. This treatment is continued till the ulcers present a healthy appearance and begin to cicatrize. Then a weak solution of chloride of lime is employed, one grain to forty-five of the vehicle. By this treatment a cure is usually effected.

Bouchut prefers using chloride of lime with honey, one drachm to the ounce.

But the remedy which is most employed in this country and

in Great Britain is chlorate of potash. It often acts like a specific for this as well as other forms of stomatitis. It may be given dissolved in water with sugar, or with one of the syrups to render it more palatable. The dose is from two to five grains every two or three hours. It should be allowed to run over the affected part, as it is believed to have a local action.

R. — Potas. Chlorat. \mathfrak{ss} ;
Mellite \mathfrak{ss} ;
Aque \mathfrak{ss} .

One teaspoonful every two or three hours.

Of all topical remedies in common use, chlorate of potash is the most safe, most easily administered, least painful, and probably the most efficacious. Some physicians prefer the chlorate of soda, on account of its greater solubility.

Follicular Stomatitis.

In this form of stomatitis the inflammation is confined to the muciparous follicles of the mouth or to them and the mucous membrane in their immediate neighborhood.

ANATOMICAL CHARACTERS.—At first there appear in the mouth minute papular elevations, red, hard, and tender, which continue to enlarge and soon become vesicular. They may now break, leaving an ulcerated surface; but if they continue entire they become purulent, and then their contents are discharged. From the commencement of the papule to the purulent transformation the period is perhaps three or four days.

The ulcer which occupies the site of the eruption is round, hard, painful, and with a vascular margin. The base has a white or grayish appearance. The reparative process soon commences, the ulcer presents a healthy appearance, its size is gradually diminished, and finally cicatrization occurs.

The liquid with which the follicles are distended in the first stages of the disease is believed to be the natural secretion somewhat modified by the inflammation.

The number of ulcerations is various. There are in most cases from six to eight to as many as twenty. They are ordinarily discrete, and one or two lines in diameter. The stages of the disease rapidly succeed each other, and the patient fully recovers in from six to eight days, but not always. In exceptional in-

stances the ulcers enlarge and become confluent, or one or more of them assume a gangrenous appearance. This indicates a faulty condition of the system, a vitiated state of the blood, due perhaps to some antecedent or concomitant disease. In these cases the ulcerative stage is apt to be protracted, and recovery doubtful.

The seat of follicular stomatitis is usually the internal surface of the lips and cheeks, the gums, tongue, and occasionally the roof of the mouth. It rarely affects the fauces. Occasionally this form of stomatitis is associated with more general inflammation of the buccal cavity. The gums may then be swollen and tender, bleeding if rubbed or pressed.

CAUSES.—The causes are not fully ascertained. Follicular stomatitis has not usually in my practice occurred in so feeble a state of system as has been present in ulcerous stomatitis. Billard, speaking of the aphthae, or ulcers of this disease, says: "They are particularly to be seen in children who are very feeble, pale, and of a lymphatic temperament. We do not look for the causes of aphthae in the retention of the meconium, acidity of the milk, or in the predominance of acidity in the fluids of the child; we attach more importance to the consideration of the original predominance of the lymphatic system, or rather to the remarkable predominance which this system acquires under the influence of bad nutrition and vitiated air which is respired in badly ventilated places in those who are crowded together with a number of sick children."

Barrier considers follicular stomatitis to be allied to those gastro-intestinal diseases which are attended by vireescence of the mucous follicles, and he mentions among the causes habitual congestion of the buccal mucous membrane, and difficult dentition. In most cases probably the exciting cause is some derangement of the digestive organs which may not be appreciable.

While simple stomatitis and stomatitis with thrush, are most common under the age of six months, follicular stomatitis is rare at this age. It is most frequent during the age which corresponds with dentition, when there is also the most rapid development and greatest activity of the muciparous follicles.

SYMPTOMS.—The constitutional symptoms in a large proportion of cases of aphthae are slight. In twelve children affected with this disease Billard found the pulse from sixty to eighty beats per minute.

The ulcers are painful, as is indicated by the cries of the child when they are pressed, and its fretfulness. Solid food, and even drinks, unless bland and unirritating, are badly tolerated. The salivary secretion is also augmented.

In these rare cases in which the ulcers become confluent or gangrenous the state of the patient is really serious. There is then often gastro-intestinal disease. The symptoms indicate prostration. The pulse is feeble, the countenance pallid, and the body and limbs become wasted.

DIAGNOSIS.—This is easy. The only disease with which it is liable to be confounded is ulcerous stomatitis. In the ulcerous form there is antecedent and accompanying stomatitis affecting a considerable part, if not the entire buccal cavity, while in the follicular form the inflammation is ordinarily confined to the immediate vicinity of the ulcers. The character of the ulcers serves also as a means of distinction. In ulcerous stomatitis there is great variety as to size and form, while in follicular stomatitis there is great uniformity in both these respects. The small, circular ulcers are characteristic of the follicular inflammation. Before the ulcerative stage the vesicular eruption serves to distinguish this form of stomatitis from all other local diseases affecting the cavity of the mouth.

PROGNOSIS.—Follicular stomatitis usually ends favorably; but if the ulcers become concrete or gangrenous, the health is seriously affected, and a more cautious prognosis should be expressed. The unhealthy appearance of the mouth, and the real danger, are often more due to the depressing effect of some concomitant disease than to the stomatitis.

TREATMENT.—In ordinary follicular stomatitis, which is discrete and attended by little or no constitutional disturbance, local remedies suffice to cure the disease. Demulcent drinks, or applications to the mouth, should be used, as the mucilage from gum acacia, marsh mallow, or flaxseed. Mild astringent lotions with the dentifrice are also beneficial. The mel boracis is one of the best and most agreeable applications. It may be placed in the mouth with a spoon, or applied with a camel-hair pencil. If there is much tenderness of the ulcers, with restlessness, a small quantity of some opiate should be added to the lotion, or it may be administered separately.

With this simple treatment the ulcers generally soon heal, and

the health of the patient is restored. If, however, the ulcers are quite painful, and not disposed to heal, or are healing tardily, they may be touched lightly with a pencil of nitrate of silver, or, as Barrier recommends, hydrochloric acid in honey of roses. This diminishes the tenderness and expedites the healing process.

If, as may in rare cases occur, the ulcerations are numerous, and are accompanied by considerable fever, there may be symptoms indicative of cerebral congestion, or even premonitory of convulsions. In such cases laxative and diaphoretic remedies are required, and sinapisms or other revulsive applications to the extremities.

If there is an unhealthy appearance of the ulcers, if they gradually enlarge, or become concrete, or gangrenous, indicating a cachectic state, tonics should be employed with nutritious and easily digested diet, and anti-hygienic influences should so far as possible be removed.

CHAPTER II.

THRUSH.

THE terms thrush, sprue, and angust, the last from the French, are synonymous. They are used to designate a particular form of inflammation of the digestive apparatus, the peculiar feature of which is the presence of points or patches of a curd-like appearance on the inflamed surface.

The usual seat of thrush is the mucous membrane of the mouth, but occasionally it affects the fauces, pharynx, and œsophagus. It is very rare in the sub-diaphragmatic portion of the digestive tube, but a few such cases have been reported by Billard and others. It never affects the membrane of the nostrils, larynx, or bronchial tubes, and it very seldom occurs in any other part of the alimentary canal without also being present in the mouth. Thrush, then, is a stomatitis, pharyngitis, or œsophagitis, or a gastro-enteritis, with the additional element which I have described.

ANATOMICAL CHARACTERS.—The first stage of thrush is that

of simple inflammation of the mucous surface. There next appear minute semi-transparent points or grains, which, increasing, soon become white and opaque. Some of them remain as points, while others extending, and, perhaps, coalescing with those adjoining, form patches of greater or less extent. The white points or patches are unequally elevated. Their central part, which was first formed, is most raised, while their circumference projects but little above the epithelium. Their highest elevation is not ordinarily more than a line above the surface. They are smaller in the pharynx and œsophagus than when occurring upon the buccal surface. They resemble closely, in color and consistence, portions of curdled milk, and the nurse often mistakes them for such, and neglects to call attention to the state of the mouth. They are readily detached by a little force, but are speedily reproduced. The color in the first days of the complaint is white, and sometimes this color continues. In other cases they assume, if the disease is protracted, a yellow hue.

Their true nature, long unknown, was finally revealed by microscopy. They consist in part of epithelial cells, and in part of a vegetable growth. This parasitic plant is in most cases the *oidium albicans*. Like other *conferve*, it consists of roots, branches, and sporules. The roots are transparent, and they penetrate the epithelial layer, sometimes even to the basement membrane. The branches divide and subdivide at an acute angle, and under the microscope they are seen to consist of elongated cells, with one or two nuclei. Around these branches are numerous sporules. In two or three instances I have examined the product of thrush removed from the œsophagus, and in both the parasitic plant was the *penicillium glaucum*, or a *confer*a closely resembling it.

In the mildest form of thrush, this morbid product is in points or small patches. If the patches are of large extent, especially if, as rarely happens, a considerable part of the buccal surface is covered by them, there is generally a state of great prostration and danger, from some antecedent or concomitant disease. Thrush is, indeed, often the sequel of some grave affection, as pneumonia or gastro-intestinal inflammation. Its complication with the last named disease is common in young, ill-fed infants, especially those deprived of the breast milk, and such cases are very apt to be fatal.

Hence, some writers who have studied infantile diseases in foundling hospitals, regard thrush as one of the most serious affections of early life. Valleix, in a book of seven hundred pages relating to diseases of children, devotes more than one-third to the consideration of muguet. Of twenty-four cases, the records of which he publishes, twenty-two died. The disease of which these infants died, was gastro-intestinal inflammation, which the author considered a part of the more general disease, muguet. Doubtless, the same cause which produced the stomatitis, with the confervoid growth in these infants, also produced the fatal gastritis or gastro-enteritis, occurring without this growth. It seems to me much better to restrict the term sprue, thrush, or muguet, to the inflammation of that portion of the mucous surface which is the seat of the parasitic growth. I reject then from my description of the anatomical characters of thrush, those sub-diaphragmatic inflammations which some writers consider an important part of this disease, and place them in the list of coexisting affections. When the fatal gastric or intestinal inflammation is accompanied by the characteristic vegetable growth on the gastric or intestinal surface, it is proper in my opinion then, and only then, to say that death occurred from thrush. This explanation seems necessary in order to understand the different statements of writers in relation, not only to the anatomical characters of thrush, but also in reference to its mortality.

The frequent coexistence of thrush with gastro-intestinal inflammation, has been remarked in the hospitals of Europe, and in the Infant Asylum and the Child's Hospital, in this city. In the post-mortem examinations of those who have died in these last institutions, having thrush at the time of death or immediately prior to it, and who for the most part have been infants under the age of three months, I have frequently found evidences of inflammation in every division of the alimentary canal. The confervoid growth was, however, seldom found below the fauces, and never below the oesophagus.

SYMPTOMS.—The symptoms in thrush are not different in most cases from those of simple inflammation. In the mildest cases they are chiefly of a local nature, such as have already been described in our remarks on simple stomatitis. If the inflammation is more extensive, especially if it affect the fauces and oesophagus,

phages, the infant becomes feverish and fretful, and the inflamed surface is hot, red, and tender. In the worst forms of thrush this surface not only presents the ordinary features of severe inflammation, namely, heat, redness, and tenderness, but it is sometimes deficient in the natural secretion, so as to present a dry or parched appearance. It is in these cases that there is often a more extensive inflammation than that of the buccal or oesophageal membrane. The sub-diaphragmatic portion of the digestive tube is inflamed. The infant in these severe cases has thirst, loss of appetite, restlessness, vomiting, and frequently diarrhoea. The countenance is anxious and pale; there is rapid emaciation, and, if the disease is not arrested, a state of extreme prostration soon occurs. The twenty-four severe cases related by Valleix, already alluded to, twenty-two of which were fatal, were examples of this severe form.

CAUSES.—Thrush is most apt to occur in those who are constitutionally feeble, or who are enfeebled by disease, or by unfavorable hygienic conditions. Cachexia is a cause common to thrush, and most other subacute inflammations of the alimentary canal. The most obvious and common of the unfavorable hygienic conditions alluded to, is the continued use of indigestible and improper food. It is, therefore, a common disease among foundlings, in institutions where these unfortunates are received, since they not only breathe an atmosphere which is often impure, but are deprived of the mother's milk, and are so frequently given a diet which is a poor substitute for it. Among the poor of the cities thrush is common, since with them, from necessity or choice, there is the greatest neglect of sanitary requirements. Exposure to humidity, to variations in temperature, increases the liability to the disease, though in less degree than defective alimentation. Billard and Valleix agree that thrush is more frequent in the warm months than in the cold, that its maximum frequency is in the months of July, August, and September. Cases in the Infant Asylum and Child's Hospital of this city, have appeared to me to correspond in this respect with those related by Billard, and Valleix. Various writers have mentioned the age at which thrush is most apt to occur, as one of the predisposing causes. Thrush is not common above the age of six months, and a majority of the cases occur under the age of three months. Infants of the age of one or two weeks, even if, in addition to lactation, they are spoon-

fed by nurses, over-anxious that they should thrive, are apt to take the disease.

DIAGNOSIS.—This is easy so far as thrush in the mouth is concerned, for simple inspection by one familiar with the disease, is all that is required in order to discover it. The presence of thrush in portions of the alimentary canal, hidden from view, cannot be positively ascertained.

The vomiting, diarrhoea, pain or fretfulness, emaciation, and rapid sinking, which sometimes accompany severe forms of thrush, indicate gastro-intestinal inflammation, to which the attention of the practitioner should be chiefly directed.

PROGNOSIS.—The duration of thrush varies according to its intensity, and the favorable or unfavorable condition of the child. If it is slight and the health of the infant otherwise good, it may often be cured in two or three days. Under other circumstances it may continue as many weeks or even longer, before it is entirely removed.

When thrush occurs in connection with gastro-enteritis the mortality is very great. It has been already stated that in Valleix's twenty-four cases, twenty-two were fatal. M. Auvity estimates the mortality of such cases at nine in ten, and M. Godinat at two in three.

TREATMENT.—As one of the most common causes of thrush is the use of indigestible or improper food, the physician should ascertain the nature of the infant's diet, and if it is faulty should direct a better. In many cases the infant is bottle-fed. It should be given only the mother's milk if practicable, or that of a healthy wet-nurse. This change of alimentation often removes the sole cause of thrush in the young infant, so that it rapidly recovers.

If artificial feeding is necessary, such diet should be advised as is directed in our remarks on the treatment of the diarrhoeal maladies. There is often in thrush an excess of acidity in the digestive tube, and an alkali is required. Trousseau recommends the addition of saccharate of lime to the milk. Children with this disease should also be taken from filthy and damp apartments, to those in which the air is pure and dry.

The remedy in common use in the treatment of thrush, and which is usually effectual, is borax. This, if applied sufficiently often to the affected membrane, not only destroys the parasitic growth, but prevents its reproduction. It is commonly used

mixed with honey, or in a powder mixed with sugar or dissolved in water. The official *mel boracis*, consisting of one part of borax to eight of honey, is so much used in families, that it may be considered almost a domestic remedy. There is, however, an objection to using any application for the removal of thrush, which contains either sugar or honey, since either substance remaining in the mouth, would rather promote the growth of the parasite. Still, it is desirable to employ a wash of such consistence that it will remain a longer time in contact with the buccal surface, than will a simple solution in water. I know no better vehicle for the borax than glycerine, which has the advantage of consistence, does not readily undergo any chemical change, and has no unpleasant flavor. The borax may be used dissolved in glycerine, with or without some flavoring ingredient:—

R.—Soda borat. ℥j ;

Glycerin ℥j.

Mix.

Borax should be used four or five times daily, and continued for a time after the disease has disappeared from sight, since the roots of the plant must be destroyed or the branches are rapidly reproduced. It should be applied by a camel-hair pencil, or with a soft cloth upon the finger or a stick. It should be so freely used in extensive and severe forms of the disease, that the infant will swallow some, as the entire oesophagus is apt to be affected in such cases. In the intervals between the applications of borax, if the buccal surface is hot, dry, and tender, so as to increase the fretfulness of the infant, it is well to use mucilaginous washes, as the mucilage of acacia or mallow. If the disease continue notwithstanding the use of these measures, the mouth should be occasionally washed with a weak solution of nitrate of silver or sulphate of zinc:—

R.—Zinc sulph. gr. ii-iv ;

Aq. Rosæ ℥ss.

Mix.

In many cases, however, the treatment of thrush is of less importance than that of the disease which the thrush complicates. The remedial measures which I have mentioned then become subordinate to those employed for the graver disease. When this disease is relieved and the general health improves, thrush is more easily and permanently cured than during the state of febrile and ill-health.

CHAPTER III.

GANGRENE OF THE MOUTH.

THE diseases of the mouth which we have been considering, are attended by little danger, but the one which we are next to consider is among the most fatal affections of early life. It is gangrene of a portion of the cheek or *gum*, or of both. It is described by writers under various names as *cantharum oris*, *noma*, *neurosis infantilis*, aqueous cancer of infants.

ANATOMICAL CHARACTERS.—Gangrene of the mouth is often preceded by ulceration of the mucous membrane, at the point where it is about to commence. This ulcer may continue a considerable time before the gangrene commences. The tissue around the sore becomes inflamed, thickened, and indurated. The induration extends, and soon the purple line of gangrene appears at or near the ulcer, and increases. The next stage in the progress of gangrene, is sloughing of the portion the vitality of which is lost.

The slough does not present the appearance of uniform decay. While the color is generally dark, there are in the mass fibres of cellular tissue or even bloodvessels, which remain unchanged or are but partially decomposed. After separation or sloughing of the part where the vitality is first lost, the surface of the excavation, if the disease is not checked, has a dark, jagged, and unhealthy appearance. Commencing with the mucous membrane and the tissue immediately underlying it, the disease extends on the one side towards the skin, and on the other towards the deeper seated structures of the jaw. According to Billard, the swelling which precedes and surrounds the gangrene, is in great part oedematous.

This disease is occasionally primary, but in a large proportion of cases it is secondary. Occurring secondarily, its symptoms are often masked by those of the antecedent and coexisting affection. Under such circumstances attention is sometimes first directed to the mouth, by the loosening of one or more of the teeth, or the

appearance on the skin of a livid circular spot, which indicates the approach of the disease to the cutaneous surface. The mucous membrane presents a dark red appearance to the distance of a few lines beyond the point of gangrene. It covers tumours which are inflamed and indurated and about to become gangrenous.

The tongue is usually more or less swollen, unless the disease is mild; an offensive odor arises from the gangrene due to the evolution of sulphuretted hydrogen, and other gases. There is great difference in the extent of the destruction, and the gravity of the disease in different cases. It may sometimes be arrested by proper applications, and a favorable change in the general health of the child at an early period, when there is little loss of substance. In other cases it extends till it perforates the cheek, or even destroys a considerable part of the side of the face, and, extending inwards, attacks the periosteum of the maxillary bone, destroying the gum and teeth, and denuding the alveoli. Recovery, if it take place at all under such circumstances, is with the loss of a portion of the bone, and with deformity.

The duct of Steno is sometimes included in the gangrenous portion, but it commonly resists the destructive process, and remains pervious.

AUS.—The age at which gangrene of the mouth occurs is usually between two and six years. In twenty-nine cases collected by Rilliet and Barthez, twenty-one were between the ages of two and six years, and the remaining eight were from six to twelve years old. Of six cases which have fallen under my observation, all were between the ages of two and six years. It is seen that the period of greatest frequency of gangrene of the mouth is different from that at which the ordinary forms of stomatitis occur.

Gangrene of the mouth may, however, occur under the age of one year. Billard reported three cases under the age of one month, but in two of these the disease does not appear to have been sufficiently marked to render it certain that they were genuine cases of this affection.

CAUSES.—This disease usually occurs in those whose systems are relaxed or cachectic. It is therefore more frequent among the poor than those in comfortable circumstances; in the city

than in the country. It is more frequently observed in the asylums for children than in private practice. Half the cases which I have seen have been in these institutions. If the constitution is naturally good, it can only occur in those long deprived of pure air and wholesome nutriment, or those enfeebled by disease.

Among the diseases which have been known to terminate in or be followed by gangrene of the mouth, are the pulmonary and intestinal inflammations, hooping-cough, and the fevers, both eruptive and the non-eruptive. Rilliet and Barthez have published a table of ninety-eight cases in which gangrene resulted from other diseases. In forty-one of these, the antecedent disease was measles, in five scarlet fever, six hooping-cough, nine intermittent fever, nine typhoid fever, seven mercurial salivation, and five enteritis. It is seen that the essential fevers were the most frequent cause of the gangrene. Of forty-six cases collected by MM. Bozley and Caillaud, the antecedent disease was measles in all but five.

One reason why so many cases of gangrene occur as a sequel of measles, is probably because this disease is accompanied by stomatitis. Simple or ulcerous stomatitis often precedes gangrene.

Diseases sometimes terminate in gangrene of the mouth, in consequence of injudicious treatment, treatment that has lowered the vitality of the system. Thus Rilliet and Barthez mention the case of a child four years old, who took the disease at the twenty-ninth day of primitive pneumonia. This child had been reduced by the application of twelve leeches, three scarifications, a large blister, and by the use of absolute diet.

The abuse of mercury was once a much more frequent cause of gangrene than at present, at least in this country, since this agent was formerly much more employed than now. In fact, most of the affections of infancy and childhood in which mercurials were formerly employed are now treated without it.

SYMPTOMS.—Gangrene of the mouth so often occurs in connection with other diseases, that its symptoms are in a large proportion of cases blended with those which arise from a distinct pathological state.

There is usually prostration more and more pronounced as the gangrene extends. The features are ordinarily pallid, but occa-

usually their normal color is preserved for a time; the expression of the face is melancholy but composed. Sometimes the child is fretful, if disturbed; at other times it will quietly consent to an examination. The suffering is not proportionate to the gravity of the disease. There is less pain often than in some of the forms of stomatitis which are attended with danger.

As the disease advances, the body and limbs gradually waste, the eyes are hollow, or if the gangrene is near the orbit, the eyelids become edematous, the lips are infiltrated, and both the lips and nostrils are often incrusted. If the cheek is perforated, alimentation is rendered more difficult and the appearance of the child is melancholy in the extreme.

The tongue is usually moist; it is occasionally swollen. The saliva flows from the mouth, either pure or mixed with offensive sanguinolent matter. Unless the disease is slight, there is the peculiar gangrenous odor. The appetite is sometimes poor, at other times it is preserved through the whole sickness. There is no vomiting or looseness of the bowels, unless from a complication. The thirst is sometimes great; the pulse is usually accelerated and feeble, except in mild cases.

The skin in the commencement of the disease is hot. When the vital force is much reduced, and especially as the disease approaches a fatal termination, the face and limbs become cool and the surface generally presents a waxen or ashy appearance. There is no derangement of the respiratory system. Those cases which are attended by a cough or accelerated respiration, are really cases of bronchitis or pneumonia, coinciding with the gangrene.

DIAGNOSIS.—Gangrene of the mouth is easily diagnosed. In those cases in which ulceration precedes the gangrene, it might be mistaken in its first stages for that form of ulcerous stomatitis, in which the ulcers assume an unhealthy appearance. The following are the distinguishing features of the two affections. Around the ulcer where gangrene is about to commence, the tissues are greatly thickened and infiltrated, or edematous, while ulcerous stomatitis begins with a submucous deposit of fibrin, and is attended by little thickening of the surrounding parts, and little or no induration or oedema. In ulcerous stomatitis, the skin over the seat of the disease presents its normal appearance, whereas in gangrene it presents a distended and

shining appearance. The destructive process in ulcerous stomatitis is also more limited than in gangrene. Deep ulcerations do not occur, or are rare. Ulcerous stomatitis is more readily healed, and it leaves no eschar, contraction, or deformity.

The differential diagnosis of gangrene of the mouth, from those cases of follicular stomatitis in which the ulcers occupying the seat of the follicles assume a gangrenous appearance, must be made by a consideration of the same facts or particulars which serve to distinguish it from ulcerous stomatitis.

Malignant pustule, of rare occurrence in the child, resembles this disease in some of its features. But the pustule always begins on the skin, while gangrene is a disease of the mucous surface primarily. In gangrene, therefore, the chief destruction is of the mucous membrane and of the submucous tissue, while in malignant pustule the chief destruction is of the skin and the subcutaneous tissue.

PROGNOSIS.—This depends, not only on the extent of the gangrene, but the nature of the disease, if there be one, which gave rise to it, and the degree of cachexia. If it occurs in connection with or as a sequel of one of the least debilitating diseases, and there is considerable vigor of system, it may often be arrested when it has destroyed only the mucous and subcutaneous tissues, so that no deformity results. The friends may congratulate themselves if the case terminate so favorably. In the graver cases, when the gangrene extends till it destroys the periosteum of the maxillary bone on the affected side, and perhaps perforates the cheek, if the child recovers it is with the permanent loss of teeth, tedious separation of the necrosed bone, and a cicatrix, which is apt to interfere with the free use of the jaw. Death is, however, the more common termination of severe cases. Occasionally the gangrene destroys the continuity of a bloodvessel, causing abundant hemorrhage, and accelerating the fatal result. In most cases, however, there is little or no hemorrhage in consequence of coagulation in the vessels.

Another serious complication occasionally arises, namely, gangrene of other parts, as of the external genital organs. The English editor of Bouchard's treatise on diseases of children, relates the following interesting case, from the *Transactions of the Edin. Medico-Chir. Society*:—

An infant eight months old became affected with gangrene of

the face, head, and hands. "The right ear and the entire hairy scalp were of an intensely black color, and on both cheeks patches existed about the size of a half-crown piece. The right thumb and the backs of both hands were similarly affected. The child was noted to have been restless and feverish on May 22d, and on the 23d a slightly darkened ring was found to have formed round the thumb, about the middle of the first phalanx; in a few hours the whole thumb was gangrenous, and the dorsum of the hand became involved. On the ear the gangrene commenced with the appearance of a fleabite, and subsequently extended rapidly to the scalp, assuming a remarkably regular form, and giving to the child the appearance of wearing a black skullcap. The pulse was observed to be very feeble and the mouth to be unaffected. Death took place in twelve hours from the first appearance of gangrene on the thumb, the child being sensible and continuing to suck well, up to a few minutes before death."

Rilliet and Barthex state that pneumoëmia is apt to arise in the course of gangrene of the mouth. Such a complication evidently diminishes materially the chance of recovery.

Whether the result be favorable or unfavorable, it is evident from the nature of the disease, that the duration is very different in different cases. The physician's attendance may be required for a week or two or for several weeks.

TREATMENT.—As gangrene of the mouth is eminently a disease of debility, all anti-hygienic influences should be removed, and the most nourishing diet, together with tonics, be recommended. The ferruginous preparations or the bitter vegetables are required.

As soon as the physician is called, he should endeavor to arrest the gangrene, accelerate the detachment of the slough, and produce a healthy and granulating state of the surrounding tissues. This is best effected by applying a highly stimulating or even escharotic agent to the inflamed surface underneath and around the gangrene. For this purpose a great variety of substances have been used by different physicians, such as acetic, sulphuric, nitric and hydrochloric acids, nitrate of silver, the acid nitrate of mercury, chloride of antimony, and even the actual cautery.

M. Tauson recommends, after removing a considerable part of the gangrenous substance with scissors or some instrument, the

application of strong muriatic acid, and when the slough is detached, of dry chloride of lime.

Killiet and Barthéz advise the use twice daily of muriatic acid or the acid nitrate of mercury, applied by a brush upon and around the slough, followed immediately by the application of dry chloride of lime, when the mouth is to be thoroughly washed with water from a syringe. They direct in the interval frequent ablution with water. After the slough has separated the escharotic is to be discontinued, and the chloride of lime used alone. If gangrene extends to the skin, a crucial incision is to be made and the escharotic applied, after which powdered cinchona is introduced and retained by a plaster. This treatment is to be continued till the gangrene is arrested and the decayed portion removed. Barrier, Valleix, and most French writers, recommend essentially the same treatment, namely, the application of undiluted escharotic agents.

A safer, less painful, and, in my opinion, preferable treatment, is that employed by many British and American physicians, namely, the use of escharotic agents diluted, or if applied in their full strength, such as are least active and penetrating. Some employ from the first topical treatments which is astringent and stimulating rather than escharotic, and they report satisfactory results.

Dr. Gerhard believes "the best local applications are the nitrate of silver if the slough be small in extent; if much larger, the best escharotic is the muriated tincture of iron, applied in the undiluted state. After the progress of the disease is arrested, the ulcer will improve rapidly under an astringent stimulant, such as the tincture of myrrh, or the aromatic wine of the French Pharmacopœia."

The local treatment recommended by Evenson and Manneß I believe to be preferable to that advised by any of the writers from whom I have quoted. I have seen it so successful, that I should employ it in all ordinary cases from the first visit. A knowledge of this treatment will be best imparted by quoting from the authors (*Diseases of Children*, 2d Amer. edit., page 188): "The lotion which we have found by far the most successful, is a solution of sulphate of copper as employed by Coates in the Children's Asylum. His formula is as follows:—

℞.—Cupel sulph. ʒj;
 Pulv. cinchona ʒss;
 Aq. ʒv.—℥.

"This is to be applied twice a day very carefully to the full extent of the ulcerations and excoarations. The addition of the cinchona is only useful by retaining the sulphate of copper longer in contact with the edges of the gums. A solution of the sulphate of zinc, ʒj to an ounce of water, by itself or combined with tincture of myrrh, Dr. Coates found to be also useful in some cases."

A moment's reflection will show us that the above treatment is far preferable, provided it is equally effectual in arresting the gangrene, to the treatment by the strong escharotics which some of our best practitioners employ.

Take, for example, the use of pure nitric or muriatic acid, which Dr. West among others recommends. This agent causes such pain that it occasions great restlessness of the child, and such stout resistance that the author advises the use of chloroform to facilitate its application. The pain occurring from it and from the inflammation which it excites, doubtless reduces the strength which it is very necessary to preserve. If the acid comes in contact with the teeth, as it generally will, it injures them irreparably, and it sometimes attacks the jaw-bone. Dr. West, advocating the use of the acid (*Diseases of Infancy and Childhood*, 4th Amer. edit., page 467), says: "In one of the cases that I saw recover, the arrest of the disease appeared to be entirely owing to this agent, though the alveolar processes of the left side of the lower jaw from the first molar tooth backwards, died and exfoliated apparently from having been destroyed by the acid." No such result follows the use of the solution of sulphate of copper, and of its efficacy I can speak confidently. In one of those severe cases, in which the disease resulted from scarlet fever, and in which there was so much debility that an unfavorable prognosis was made, I succeeded in arresting the disease by the use of Dr. Coates's prescription. The child recovered with the loss of two teeth, and the corresponding portion of the maxillary bone.

The application should be made twice a day till the gangrene is arrested, and healthy granulations appear.

The gases arising from the gangrenous mass are not only highly

offensive to others, but they are doubtless injurious to the patient, who is constantly inhaling them. To remove this odor, one of the preparations containing chlorine should be occasionally used between the applications of the sulphate of copper. Labarraque's solution, one part to eight or ten parts of water, is an eligible form for its use. When the gangrene is removed, and the granulations present a healthy appearance, all danger is usually past, and convalescence is fully established. Then no energetic topical treatment is required. A mild stimulating lotion, like the tincture of myrrh, as recommended by Dr. Gerhard, suffices with the aid of tonics and nutritious diet.

CHAPTER IV.

DENTITION.

THE part which dentition bears in the causation of disease is not fully ascertained. We know that the opinion formerly entertained in the profession, and now prevalent in the community, that a large proportion of the affections of infancy arise directly or indirectly from it, is erroneous. Still, many of the best authorities in infantile pathology concur in the belief that difficult and painful evolution of the teeth frequently causes derangement in the functions of organs, even those remote from the mouth, and sometimes produces in them a real pathological state. They, therefore, frequently speak of dentition as a cause of disease. On the other hand, there are physicians equally good observers, and the number is increasing, who almost wholly ignore the pathological results of dentition. They say that as it is strictly a physiological process, it should, like other such processes, be excluded from the domain of pathology. Experience, they assert, corroborates this opinion, and therefore dentition should seldom, if ever, be interfered with by the lancet or other means.

A moment's reflection will show how important it is to understand the exact relation of dentition to infantile diseases. Every physician is called now and then to cases of serious disease, inflammatory and others, which have been allowed to run on with-

out treatment, in the belief that the symptoms were the result of dentition. I have known acute meningitis, pneumonia, and entero-colitis, even with medical attendance, to be overlooked, during the very time when appropriate treatment was most urgently demanded. Many lives are lost in this manner, especially from neglected entero-colitis, the friends and even physicians believing the diarrhoea to be symptomatic of dentition, a relief to it, and therefore not to be treated. Such mistakes are traceable to the erroneous doctrine, long inculcated in the schools, that dentition is directly or indirectly the cause of a large proportion of infantile diseases and derangements.

May there not be an error in the opposite direction? May not some diseases be rendered milder, and their favorable termination more certain or probable, by measures calculated to relieve the turgescence of the gums? If so, those who totally disregard the state of the gums, are not less in error than those who use the gum lancet, when it is not required.

I shall endeavor to point out what is really ascertained in regard to the relation of dentition to disease.

The first dentition commences at the age of about six months and terminates at the age of two and a half years. The corresponding teeth of the two sides pierce the gum at about the same time. The two inferior central incisors first appear at about the age of six or seven months, followed in the order in which they are mentioned, by the upper central incisors, upper lateral incisors, lower lateral incisors, the four anterior molars, the four canines, and lastly, the four posterior molars.

The incisors usually appear in rapid succession, so that all are in sight by the age of one year. From the age of one year to sixteen months, the anterior molars penetrate the gum, from the age of sixteen to twenty-four months, the canines, and from twenty-four to thirty months the posterior molars.

This order is not always preserved. Sometimes the upper central incisors appear before the lower, and sometimes the lower lateral before the upper lateral. In rare cases there have been teeth at birth. I have seen but one or two infants with such premature dentition. Retarded dentition is much more common. Those who have scrofula or rickets, or are feeble either constitutionally or by disease, often have no teeth till considerably after

the usual period. In such the first incisors may not appear till the age of twelve months, or even later.

PATHOLOGICAL RESULTS OF DENTITION.—The evolution of the teeth is commonly attended by more or less turgescence around the dental bulbs. This is greater with some of the teeth than with others. Thus the superior incisors cause more swelling than do their congeners of the inferior jaw. The turgescence, although it may be attended by more or less congestion, is so common that it is hardly proper to call it a disease. Turgescence, with redness and more or less tenderness of the swollen gum, may be considered the simplest pathological state.

In other cases there is an unusual amount of swelling around the dental follicles, the afflux of blood to them is greatly augmented; they are the seat of such a degree of tenderness and pain that the infant is fretful. It carries the finger often to the mouth, indicating the seat of its suffering. The surface over the follicles presents greater redness than in ordinary dentition, and the salivary secretion is considerably increased. There is now actual *gingivitis*.

Sometimes the inflammation affects a greater extent of the buccal surface than that lying directly over the follicles, so that most writers speak of *stomatitis* as one of the results of dentition. In a few cases I have known such a degree of inflammation over the advancing tooth, that a small abscess formed, producing much pain and restlessness, till it was opened by the lance.

The pathological results of dentition which I have mentioned are unimportant in comparison with others not yet alluded to. They do not endanger the life of the child. They are easily detected. They result directly from the rapid growth and augmented sensibility of the dental follicles.

There are other accidents of dentition occurring in distant parts of the system in consequence of that mysterious relation, and inter-dependence of organs which exists through the ganglionic system of nerves.

These accidents are more serious, and their relation to dentition is obviously less readily ascertained, than are those located in the mouth. The most common of them occur in the stomach and intestines.

Some children, previously to the eruption of the teeth, are affected with diarrhoea, occasionally accompanied by irritability of

stomach. Some writers have supposed that gastro-intestinal inflammation is present in these cases; others that there is simply a hyper-secretion, an increased activity of the intestinal follicular apparatus, that it is, in other words, one of the forms of non-inflammatory diarrhoea. Barrier believes that the diarrhoea of dentition depends usually on what he calls a "subinflammatory turgescence limited to the gastro-intestinal follicular apparatus." He believes that, in occasional cases, it is due to defective or altered innervation. It would then be analogous, or similar to that form of diarrhoea which occurs in the adult from the eruptions. Bouchet calls the diarrhoea of dentition nervous diarrhoea. It is certain, however, that in most cases of diarrhoea which are attributed to dentition there are other causes, such as unwholesome food, or residence in an insalubrious locality. It is certain as regards city infants, that the chief causes of diarrhoea during the period of dentition, are strictly anti-hygienic, dentition being quite subordinate as a cause, and probably often not operating at all as such. But when, as sometimes happens, at each period of dental evolution, the infant is affected with diarrhoea, the influence of teething is apparent. Such cases enable us to see that teething may really sustain a causative relation to certain diseases not located in the buccal cavity.

Among the most common pathological results of difficult dentition, are certain affections referable to the cerebro-spinal system. Eclampsia is one of the admitted results. Barrier attributes convulsions in the teething infant to excitement of the nervous system arising from the pain which is felt in the gums, and to a determination of blood to the dental apparatus, in which afflux the whole vascular system of the head participates.

In most cases of convulsions occurring during the period of dental evolution, a careful examination discloses other causes in addition to the state of the gums. Difficult dentition must then be considered, not so frequently a direct as a co-operative or predisposing cause, producing a sensitive state of the nervous system, or possibly an afflux of blood to the head, of which Barrier speaks, and which, by an additional stimulus, perhaps trivial, in itself, ends in convulsions. In exceptional instances, eclampsia occurs mainly from dentition, or if there are other causes, they are quite subordinate. This may happen when several teeth penetrate the gums at or about the same time. It

infants who are burnt or scalded are very liable to clonic convulsions. This is in fact the chief danger as regards life from such accidents. So the swollen and tender gum, if several teeth are about emerging, may affect the cerebro-spinal system like the burn or scald, and produce the same nervous phenomena. Thus, in a case already alluded to in the chapter on convulsions, five incisors pierced the gum within about two weeks, and in this period, there were two attacks of eclampsia with an interval of a few days. The attacks were not severe, and the most careful examination could discover no other cause, than the simultaneous development of so many dental follicles. Previously, and since, the infant has been well.

Dentition sometimes, though rarely, occasions also tonic convulsions. The following case occurred in the practice of Dr. A. S. Church, of this city, the history of which he has kindly communicated, as follows:—

"H., seven months old, was first visited April 3d, 1862. The patient had been fretful for several days, but about daylight on the morning of my first visit it commenced crying, and had not ceased for a moment at the time of my visit, 9 A. M. The bowels were somewhat constipated and tympanitic; abdominal muscles very tense. The pain was supposed to be in the abdomen, and a brisk cathartic, to be followed by an anodyne, was ordered. Some relief followed, but on the ensuing and for several consecutive mornings, the pain returned, each day lasting longer, until the child only ceased crying while under the influence of a full anodyne. The gum over the upper incisors was considerably swollen, hot, and dry, but the parents would not consent to have it scarified. For the first week there was no fever, no vomiting, and not the least indication that the nervous system was suffering. About the 10th, the thumbs were noticed to be flexed during the attack of pain, and about the 15th the flexors of the toes were contracted and the hands were turned backwards and outwards, but only while the child was awake. About the 20th there was constant contraction of the flexors of both extremities, with opisthotonos, and constant rolling of the head, loss of appetite, progressive emaciation, coated tongue, and highly inflamed gums. Consent was, finally, obtained to relieve the inflamed gum, and free incisions were made, and the following night the child slept comfortably for three hours without opiates. In three days the gums were freely cut again, and the teeth soon made their appearance. All symptoms of disease had now ceased, the child became playful, and on the 30th the patient was discharged."

The opinion has been prevalent in the profession, and is now held by many, that infantile paralysis commonly results from difficult dentition. It is now, however, ascertained that the

immediate cause of those forms of paralysis formerly called dental, is often some disease of the cerebro-spinal axis. Dr. Von Heine collated the records of nearly two hundred cases, and in the majority of these, he concluded that there was a spinal lesion antecedent to, and producing the paralytic affection.

Farther observations are required as regards infantile paralysis, in order to ascertain its exact relation to dentition. Many of the best authorities in infantile pathology regard dentition as one of its causes, and, in our present knowledge of the subject, we must believe that it does have a causative influence, but in a less degree than was formerly supposed.

Some writers are of opinion that acute meningitis occasionally results from difficult and painful teething. The facts, however, that are relied upon to prove this are uncertain. The relation of dentition and meningitis is probably oftener that of coincidence than of cause and effect.

Teething less frequently disturbs the respiratory system than either the digestive or cerebro-spinal. A cough occurs in some infants at each period of dental evolution.

Bronchitis and pneumonia, so common in young children, occur independently of dentition.

Acceleration of pulse is often observed at the time of greatest swelling and tenderness of the gum. It subsides with the protrusion of the tooth. The febrile movement of dentition is irregular, sometimes presenting a remittent form, like remittent fever or the fever promonitory of meningitis.

DIAGNOSIS.—The accidents of dentition which are located in the mouth are easily diagnosed, unless the odontalgia which some writers describe, and which is not necessarily attended by any perceptible anatomical alteration of the gums. Those accidents which pertain to remote and concealed organs are usually detected with ease, though it is often difficult to determine with certainty their relation to dentition.

When similar symptoms arise at each epoch of teething, and subside with the subsidence of the gingival turgescence, teething must be regarded as the cause. Or, if the disease is such as is known to be produced occasionally by difficult teething, and if, after a careful examination, we can discover no other cause, while the gums are swollen, especially over two or more advancing teeth, it is proper to refer the disease to dentition.

It is evident that we must often be in doubt whether the disease which we are treating is due at all to the state of the gums, or, if so, whether directly or indirectly, or to what extent; but as a rule, if any other cause is apparent, we may properly regard the influence of dentition as quite subordinate.

TREATMENT.—It is obvious that remedial measures in cases of difficult dentition, must be twofold, namely, those directed to the state of the gums, and those designed to relieve the derangements or diseases to which dentition has given rise. If there is diarrhoea, this should be controlled by proper remedies, so as to reduce the number of evacuations to two or three daily. It is well to state to the friends of the child, who believe that diarrhoea is salutary during the period of teething, that this number is quite sufficient, and that more frequent evacuations will endanger the safety of the child.

The nervous affections, as convulsions, require such soothing and derivative measures as are recommended in our remarks on diseases of the nervous system. The rational employment of therapeutic measures requires strict attention to be given to the causes of disease. Therefore the physician called to treat an ailment, believed to be due to dentition, should not fail to examine the state of the gums, and adopt such measures as will mitigate the intensity of the cause; in other words, diminish the tenderness if not the swelling of the gum. Demulcent and soothing lotions are recommended by some. The infant should be allowed to hold in the mouth an India-rubber or ivory ring, which by pressure on the gum gives considerable relief.

Mothers will often attempt to "rub through a tooth," as they term it, by means of a ring or thimble. This should be discouraged. So great friction cannot fail to have an injurious effect, by increasing the swelling and inflammation, unless the tooth has already reached the mucous membrane.

We come now to a subject which has engaged the attention of many of the ablest and most experienced physicians, and in reference to which there is still a difference of opinion among the highest authorities in medicine. I refer to scarification of the gums.

The gum lancet is now much less frequently employed than formerly. It is used more by the ignorant practitioner, who is deficient in the ability to diagnose obscure diseases, than by

one of intelligence, who can discern more clearly the true pathological state. Its use is more frequent in some countries, as England, under the teaching of great names, than in others, as France, where the highest authorities, as Billaud and Bartholin, discountenance it.

It is well to bear in mind, as aiding in the elucidation of this subject, the remark made by Trousseau, that the tooth is not released by lancing the gum over the advancing crown. The gum is not rendered tense by pressure of the tooth, as many seem to think, for if so, the incision would not remain linear, and the edges of the wound would not unite as they ordinarily do by first intention within a day or two. This speedy healing of the incision, unless the tooth is on the point of protruding, is an important fact, for it shows that the effect of the sensitization can only last one or two days. The early repair of the dental follicle is probably conservative so far as the development of the tooth is concerned. It may help us to understand how active, how powerful, the process of absorption is, if we reflect that the roots of the deciduous teeth are more or less absorbed by the advancing second set, without much pain or suffering from the pressure. If the calcareous particles of the teeth are so readily absorbed, what is the foundation for belief that the fleshy substance of the gum is absorbed with such difficulty? This idea of tension and resistance of the gum from difficulty of absorption must be abandoned.

Follicles during the period of development are especially liable to inflammation. We see this in the follicular stomatitis and enteritis, so common when the buccal and intestinal follicles are in the state of most rapid growth. Does not this law in reference to the follicles hold true of those by which the teeth are formed, so that the period of their enlargement and greatest activity, which corresponds with the growth and protrusion of the teeth, is also the period when they are most liable to congestion and inflammation? This fact affords a better explanation of the frequency of the so-called laborious or difficult dentition, than that it is due to the resistance which dental evolution encounters from the gums.

If there are no symptoms, except such, as occur directly from the swelling and congestion of the gum, the lancet should seldom be used. The pathological state of the gum which would,

without doubt, require its use, is an abscess over the tooth. As to symptoms which are general or referable to other organs, as fever and diarrhoea, the lancet should not be used if the symptoms can be controlled by other safe measures. All coexisting causes should first be removed, when in a large proportion of cases the patient will experience such relief that scarification can be deferred.

If the state of the infant is such that life is in danger, as in convulsions, or there is danger that the infant will be permanently injured or disabled, as by paralysis, every measure which can possibly give relief should be employed without delay. In these dangerous nervous affections, therefore, the gums if swollen should be bled. I know no accidents of dentition which require prompt scarification, except suppurative inflammation of the gums, convulsions, and paralysis. In other cases the operation may be safely postponed, till other measures have been employed.

Second Dentition.

The fact is well established, though often overlooked in practice, that second dentition occasionally deranges the functions of organs, and gives rise to pathological symptoms. Billiet and Barthez mention particularly neuralgic pains, rebellious cough, and diarrhoea, as effects which they have observed. Billiet relates the case of a girl eleven years old, who had a very obstinate and protracted cough, the paroxysms lasting often half an hour to an hour. This cough immediately and permanently disappeared when the molars passed the gums.

Dr. James Jackson, in his *Lectures to a Young Physician*, says: "I have seen persons between twenty and thirty years of age much affected by a swollen tooth not yet protruded, and distinctly relieved by cutting the gum. But I think the most common period of suffering from the second dentition, is from the tenth to the thirteenth year. The most characteristic affections are wasting of flesh and nervous diseases. The boy loses his comeliness, and his complexion is less clear, while emaciation takes place in every part, though mostly, perhaps, in the face. The nervous symptoms are various, but the most common are a change in the temper and a loss of spirits. With these there is some loss of strength. The patient is unwilling to engage in

play, and soon becomes tired when he does do it. Among the distinct symptoms which are not uncommon, I may mention pain in the head and in the eyes. The headache is not commonly severe, but it is such as inclines the patient to keep still. The eyes are not only painful, but are often affected with the morbid sensibility to which these organs are subject. I have known boys truly anxious to pursue their studies, obliged to give them up on this account; and these not having the disposition to play, will of choice pass the day with their mothers, and increase their troubles by the want of air and exercise. Nervous affections of a more severe character are sometimes manifested.¹

Whether the symptoms which have been attributed to second dentition have always been due to this cause, is questionable. Practically, however, it matters little, whether we recognize dentition as the cause, or assign something else. Hygienic and medicinal measures to improve the general health, will usually suffice to relieve the patient. I have known a boy, pallid and of nervous temperament, about seven years old, recover immediately from a cough which had lasted for several weeks, by taking three times daily a mixture of iron and astric acid. Many do well without medicine, simply by hygienic measures. Dr. Jackson says, "The remedies which I have found most useful are as follows: First, a relief from study or from regular tasks, yet using books so far as they afford agreeable occupation or amusement. Second, exercise in the open air, preferring the mode most agreeable to the patient, and in more grave cases the removal from town to country."

CHAPTER V.

SIMPLE PHARYNGITIS, RETRO-PHARYNGEAL ABSCESS, CESOPHAGITIS.

CHILDREN of all ages are liable to inflammation of the pharynx. In its mildest form it often, doubtless, escapes detection in the young infant. In older patients it is revealed by pain in swallowing solid food, and more or less tumefaction below the

ears apparent to the sight. It is said to be less frequent in infancy than in childhood. In the adult, and in children over the age of four or five years, inflammation of the pharyngeal surface is often confined to the portion of membrane which covers or immediately surrounds the tonsils. It occurs in connection with inflammation of these glands. But in infancy and early childhood this limitation is comparatively rare. Inflammation of the throat at this age is ordinarily a general pharyngitis, the tonsils participating in the morbid state.

Pharyngitis is primary or secondary. The secondary form occurs in measles, scarlet fever, bronchitis, croup, pneumonia, and occasionally in other affections. As these diseases are common, physicians are oftener called to treat patients who have the secondary form than the primary. Rilliet and Barthex met eighty-three secondary to sixteen primary.

ANATOMICAL CHARACTERS.—The pathological anatomy of pharyngitis is ascertained by depressing the tongue and inspecting the fauces. The membrane lining the fauces is seen to be redder than in health, and presenting a more or less swollen appearance, according to the intensity of the inflammation. In idiopathic pharyngitis, the fauces commonly have a bright red hue, almost like that of arterial blood. If, on the other hand, the inflammation occurs in connection with a constitutional affection, the hue is apt to be darker. In grave cases of scarlet fever or measles, it is sometimes even livid, indicating a vitiated state of the blood, a condition of real danger. The tonsils are tumefied so as to project, though not to the extent which we often observe in the adult. They are also less firm than in the normal state. The follicles of the throat are enlarged and active, pouring out a mucopurulent secretion. This is sometimes seen in a layer over the tonsil or the posterior portion of the fauces. In a case of primary pharyngitis, examined after death by Rilliet and Barthex, the tonsils were softened, infiltrated with pus and slightly enlarged. A layer of bloody mucus lay on the pharynx, and the pharyngeal surface was dark red, thickened and granular. The submaxillary glands were also swollen and somewhat softened.

If the inflammation is intense, the deep-seated portion of the tonsil becomes involved, and even sometimes the adjacent cellular tissue. In most cases, by applying the finger in the hollow below

the ears, the tonsil can be felt. In severe cases, also, the sub-maxillary glands are tumefied.

CAUSES.—The usual cause of primary or idiopathic pharyngitis is exposure to cold. It also occasionally occurs from the use of drinks too hot or containing some irritating substance. I have met it in the most intense form caused by swallowing boiling water, and, in one case, from acetic acid taken through mistake. When it occurs from the eruptive fevers, it is part of a more extensive mucous phlegmasia, although the inflammation is often, as in scarlet fever, more intense in the pharynx than elsewhere.

SYMPTOMS.—Tenderness of the pharynx, and pain on swallowing, announce pharyngitis. These symptoms are not so readily detected in infancy as in childhood. They are not always proportionate to the intensity of the inflammation. The tongue is slightly furred; there is thirst, and the appetite is more or less impaired. The breath is foul, but not fetid; the respiration is normal, or but slightly accelerated; cough is sometimes present, sometimes absent. When present, it is due to extension of inflammation to the upper part of the larynx, or to the collection of mucus around the aperture of the glottis.

When the tonsils are considerably enlarged, and the adjacent parts much swollen, the voice is, sometimes, much altered, presenting a nasal character. The pulse in pharyngitis is accelerated, and the temperature of the surface elevated according to the severity of the inflammation.

PROGNOSIS.—In mild cases of pharyngitis convalescence commences within a week. If the inflammation is dependent on a constitutional affection, it may continue a much longer time, especially if the glands of the neck and the cellular tissue are much involved. The prognosis of secondary pharyngitis is less favorable than that of the primary form. In fatal cases there is usually a vitiated state of the blood, either from the coexisting constitutional disease, or from previous *œdemia*. The younger the child also the less favorable the prognosis.

Pharyngitis may, however, become dangerous from complications to which it gives rise. The proximity of the inflammation to the brain, or its effect upon the cerebro-spinal system, through the reflex nerves, sometimes gives rise to clonic convulsions. In a recent case of primary pharyngitis in my practice, repeated and violent convulsions occurred in an infant, about one year old,

from this cause. They commenced at the inception of the inflammation, and constituted the only real danger. Pharyngitis may interfere materially with nutrition in consequence of the dysphagia, but in most cases of primary pharyngitis this symptom does not continue sufficiently long to endanger the life of the patient. In grave constitutional affections, as scarlet fever, the difficulty of swallowing, and the consequent inanition, augment the danger. As regards, therefore, the prognosis in simple pharyngitis, whether primary or secondary, it may be stated as a rule, that it is not, *per se*, a fatal disease, but is only so from complications, or from aggravating the primary affection with which it is associated.

DIAGNOSIS.—This is never difficult provided attention is directed to the throat; but the physician often fails to discover it at his first visit, from neglecting to examine this part. In many cases the local symptoms are not well-marked, and in the absence of these, the febrile reaction may at first be referred to some other cause than the true one. Inspection not only reveals the presence of inflammation, but enables us to determine whether it is simple pharyngitis, or diphtheritic, or ulcerative. In some instances, simple pharyngitis resembles diphtheritis, from the presence of coniferoid growths upon the inflamed surface, usually the *leptothrix buccalis*. The differential diagnosis is based on the easy removal and soft pulsatious character of the congeries, and the appearance under the microscope.

TREATMENT.—*Mild* cases of simple pharyngitis require little treatment. With moderate counter-irritation over the throat, and the use of laxative medicines, the inflammation soon subsides. The linimentum camphoræ may be occasionally rubbed over the throat, and retained upon it by flannel. The effect is increased by the application, once or twice daily, of mustard or tincture of iodine, or by adding to the liniment a little volatile liniment or turpentine. Mucilaginous and refrigerant drinks, with a light diet, suffice to complete the cure.

In the *severe* form of idiopathic pharyngitis more active measures are required. The bowels should be freely opened, warm mustard pediluvia occasionally employed, and the head be kept cool. If the patient is robust, is in the first stages of the disease, and there is threatening of cerebral complication, it is proper to

apply one or more leeches to the temples or neck; but cases requiring such depletion are exceptional.

Diaphoretics and sometimes cardiac sedatives are indicated, such as liquor ammoniæ acetatis, spiritus ætheris nitrosi, ipœcuanha, tartrate of antimony and potassa, aconite, and veratrum viride. Medicines of this kind may be variously combined according to the age and condition of the patient, and the severity of the disease. Saline laxatives are also in some cases useful.

As the symptoms abate, the intervals between the doses may be increased. In these cases of severe idiopathic pharyngitis, attended by pain in deglutition, moderate but constant counter-irritation should be employed over the seat of inflammation. An excellent application, and one much used in families, is a slice of fat salt pork, cut as thin as possible, stretched on a single thickness of muslin, and applied from ear to ear. It is better, usually, to sprinkle more salt upon it, and sometimes powdered camphor.

In cases of much tenderness and dysphagia great relief is often obtained by emollient poultices applied over the throat. Mustard or iodine may also be occasionally employed in addition if there is not already sufficient counter-irritation.

Topical treatment of the pharynx is recommended by most authors. Billiet and Barthès use for this purpose nitrate of silver or powdered alum. The former has been most employed by physicians. It may be applied in the proportion of ten grains to the ounce, two or three times daily. I have commonly prescribed the liquor ferri subsulphatis mixed with three or four times its quantity of glycerine, for application to the inflamed part, and with satisfactory results.

Gargles, which we so often prescribe in the pharyngitis of adults, cannot be satisfactorily employed in infancy and early childhood.

The treatment of secondary pharyngitis will be described in connection with the treatment of the diseases which it complicates. Suffice it here to say that this form of inflammation must not be treated by those depressing remedies which are useful in certain cases of idiopathic pharyngitis.

Pseudo-membranous pharyngitis, or diphtheria, being a zymotic disease, will be described elsewhere.

Retro-Pharyngeal Abscess.

Every practitioner should bear in mind the fact that an abscess occasionally forms between the pharynx and vertebral column. This constitutes a disease which is apt to be fatal, but which can ordinarily be promptly relieved by the surgeon.

Yet, if we look over the records of retro-pharyngeal abscess, we shall see that in a large proportion of published cases, the disease was supposed to be something else, and so treated until its nature was revealed by post-mortem examination. The most complete monograph on this disease with which I am acquainted was published by Dr. Allen, of this city, in the *N. Y. Journ. of Med.* for Nov. 1851. To this paper I am largely indebted for facts.

AGE. CAUSE.—This disease may occur at any age; but it is most common in infancy and childhood. It is more frequent in the first year of life than at any other period. Of the cases collated by Dr. Allen, in which the age is stated, twenty were under ten years, while the number for all other ages was twenty-one. This disease arises in some patients from caries of the vertebral column, and, in others, from inflammation commencing with the mucous membrane, and extending to the submucous cellular tissue, between the pharynx and the spine. Whichever the cause, there is usually a septicæmic or reduced state of system.

Writers describe two kinds of retro-pharyngeal abscess, the primary and secondary. This distinction is based on the fact, whether or not the inflammation which leads to the abscess is dependent on an antecedent pathological state.

In the primary form the cause is usually atmospheric, or it is some irritating substance which has been swallowed, and which, lodging in the pharynx, produces pharyngitis.

The cause is mentioned in twenty cases of the primary form, collated by Dr. Allen, as follows: exposure to cold, ten cases; lodgment of bone in pharynx, eight cases; blow with a fencing foil, one case. In the last case, the button of a fencing foil passed through the right nostril into the pharynx.

The secondary form occasionally occurs after measles and scarlet fever. The inflammation of the pharynx, common in those diseases, extends to the subjacent cellular tissue, and, aided by the dyscrasia of the patient, becomes suppurative. Such cases have been observed by Killiet and Bartlett. The most common cause

of the secondary form is, however, caries of the vertebral column. When thus occurring, it is similar, both as regards cause and nature to lumbar abscess. It would follow the same chronic course, and would properly be described in connection with it, were it not for its proximity to the air passages, which renders the disease so rapid and fatal. In a few recorded cases the abscess has been a sequel of erysipelas. It is believed by some that when it thus occurs there is retrocession of the erysipelatous eruption. In nineteen cases of secondary abscess in Dr. Allen's collection, the cause is assigned as follows: erysipelas of face, two; inflammation following a fall upon the inferior maxilla, one; after cerebritis, one; syphilis, four; caries of the cervical vertebra, six; scrofula, five.

The proximate cause of retro-pharyngeal abscess is believed by Mr. Fleming (*Dublin Journ. of Med. Sci.*, vol. xvii.) to be in some instances inflammation of small lymphatic glands lying between the pharynx and the vertebra. After remarking that two cases which he reports lend confirmation to this view, he continues: "That those glands are only occasionally found in this situation, I admit, and hence, probably, the rare occurrence of this particular form of disease, but that they exist more frequently than is generally imagined, I am equally certain." Prof. Geo. T. Elliot relates a case (*Obstet. Cases*, N. Y., Appleton & Co., 1868) in which retro-pharyngeal abscess immediately followed and was apparently due to parotiditis. The patient was a boy seven months old.

In rare instances the abscess, or the local disease which leads to it, appears to exist from birth. Thus Dr. E. O. Hocken relates in the *Prov. Med. and Surg. Journ.*, 1842, the history of an infant who died at the age of nine weeks. It had always, when taking the breast, thrown back its head as if nearly suffocated. The walls of the abscess were thick and firm, described by the writer as cartilaginous. Occasionally there is no apparent cause of the abscess. We must then attribute it to some unknown dyscrasia.

ANATOMICAL CHARACTERS.—The seat of the abscess is not the same in all cases. The swelling can ordinarily be seen on examining the fauces, but occasionally it is so low as to be really retro-esophageal, and therefore invisible. The size of the abscess varies; sometimes it is large, crowding forward the posterior wall of the pharynx even against the velum palati, and

into the posterior nares, if the abscess have a high location. Or if lower, against the larynx, so as to embarrass respiration. Sometimes the abscess is so large or has such lateral extension that there is external swelling along the side of the neck. In a few cases on record the pus, instead of being discharged into the pharynx, made its way down the neck between the muscles and the cellular tissue to the pleural cavity, which it entered, producing fatal pleuritis.

The walls of the abscess have been found in a different state in different cases. Sometimes the sac, at the projecting point, is so thin that it seems as if there might have been a spontaneous cure could life have been preserved a few hours longer. In other cases the sac is so thick and firm that its rupture, for many days, would be impossible.

SYMPTOMS.—The precursory symptoms differ in different cases, according to whether the abscess results from pharyngitis or from disease of the spinal column. If from the first cause, the symptoms which precede the abscess are in great measure such as have already been described under the head of simple pharyngitis, but the pain and tenderness are commonly referred more to the posterior portion of the pharynx than to the lateral or anterior. If the abscess proceed from vertebral disease, it is preceded by deep-seated and protracted pain, greatly increased by movements of the head.

When the inflammation becomes suppurative and the abscess forms behind the walls of the pharynx, the febrile reaction continues, or there are alternations of heat and chills. The patient is restless, mouth hot and dry; tongue furred; deglutition more or less difficult. The symptoms indicate approximately the seat of the inflammation, but on examination we do not find that degree of redness and swelling of the mucous surface which we had been led to expect. The tissues which are chiefly involved in the inflammation being submucous, are hidden from view. We observe redness, especially of the posterior portion of the pharynx, but disproportionate to the intensity of the symptoms. Sometimes there is a sensation of chilliness through the entire period of the abscess, though greater at one time than at another. In young infants convulsions may occur at any period of the disease, greatly increasing its danger. In the course of a few days new symptoms arise. There is now embarrassment of respira-

tions, which gradually increase. It is noticed both during inspiration and expiration. The dysphagia increases, and finally reaches such a degree that the use of solid food is necessarily abandoned. At this period the respiratory symptoms often resemble those of croup, for which the disease is sometimes mistaken. There is whistling or labored respiration from the pressure of the tumor on the posterior wall of the larynx, and the voice is consequently feeble or indistinct. These symptoms are not always present; some of them may be absent. Thus Abercrombie saw a case in which there was no marked dysphagia.

When the symptoms have reached this degree of intensity the tumor can ordinarily be seen, on depressing the tongue, occupying the posterior fauces and almost obliterating the cavity of the pharynx. If the finger is carried back so as to press upon the tumor, it is observed to be elastic, but from the impossibility of proper examination fluctuation may not be detected.

If the pus is not evacuated spontaneously or by the surgeon, the dyspnea soon becomes extreme. The features are livid; there are frequent paroxysms in which the difficulty of breathing is augmented so as to threaten immediate suffocation. Coughing or attempts to swallow induce these paroxysms, and the patient is forced to remain in an erect or semi-erect posture. The tongue is protruded; the head thrown back; the pulse is frequent and rapid; the limbs become livid and cool, and finally death occurs from asphyxia. Occasionally, when death seems inevitable, the abscess gives way by the struggles of the child, and the patient is restored to health. In rare cases the result is different. The trachea and bronchial tubes are deluged by the purulent discharge and immediate suffocation occurs.

A correct appreciation of the symptoms and the nature of retro-pharyngeal abscess will be best obtained by relating a case. I select the following from the *Transactions of the London Pathological Society*, October 20th, 1846:—

A female infant died at the age of seven months, having had difficult breathing three weeks, and extreme dyspnea during the last days of life. The dyspnea was constant, and was aggravated by mental excitement, by movements of the body, and by exposure to cold. During these paroxysms of dyspnea a peculiar croupy sound accompanied inspiration. There was no dysphagia through the entire sickness, and death occurred from asphyxia.

The sac of the abscess was of the size of a pigeon's egg, and was situated between the upper cervical vertebrae and the back of the pharynx. The abscess was flattened in front so as not to cause any material prominence of the posterior wall of the pharynx. From the sac a second small cyst extended forward, forming a nipple-like swelling in the pharynx, which completely closed the orifice of the glottis. Its aperture of communication with the body of the abscess admitted the point of the little finger, and the whole swelling was freely movable and perfectly translucent at its extremities and sides. Apparently the walls of the abscess might have been easily punctured during life with a favorable result.

The duration of this disease is very different, according to the severity of the inflammation, the rapidity with which the abscess enlarges, and the direction which it points. A lateral or downward extension is not so immediately dangerous to life as the anterior.

The time when the abscess begins to form cannot be precisely ascertained, and most writers, in determining the duration of the disease, compute from the time when symptoms referable to the pharynx were first observed. Dr. J. Byrnes relates, in the *Amer. Journ. of Med. Sci.*, 1838, a fatal case which lasted seven days. The patient was an infant one year old, and died of apnoea. The abscess was large, extending from the base of the skull to the thorax, and pressing both on the larynx and trachea. M. Bessier (*Archiv. Gén. de Méd.*, 1849) gives the history of an infant four months old, who died in the same way after thirteen days. An infant nine months old, whose case was published by Dr. W. C. Worthington, in the *Proc. Med. and Surg. Journ.*, 1842, lived nine days. The abscess occurred from exposure to cold; the patient was treated for croup, and died from suffocation. The anterior wall of the abscess was very thin.

Sometimes, when the abscess presses but slightly on the air passages, the case may continue for weeks or even months. Such a case was observed by Prof. Willard Parker (Allin). This infant was one year old; it suffered from pharyngeal symptoms nine months, was treated for tonsillitis, and death occurred as usual from apnoea. The abscess was two inches long, and there was no disease of the vertebrae. The same surgeon saved the life of another patient four years old, in whom the disease was

chronic, by puncturing the abscess; and Prof. Post, of this city, also treated successfully a case which had continued three months. (Allin.)

DIAGNOSIS.—The diagnosis of this disease is ordinarily not difficult, provided the physician examine carefully and bear in mind the occasional occurrence of such an abscess. In a large proportion, however, of the recorded fatal cases, the true nature of the disease was not recognized during life. Especially is the diagnosis difficult when the cerebro-spinal system is early implicated, and symptoms arise which divert attention from the throat to the brain.

The diseases with which retro-pharyngeal abscess is most frequently confounded, are croup and simple but severe pharyngitis. Eminent physicians and surgeons confess that they have made this error of diagnosis. From croup, for which it has been most frequently mistaken, it may be distinguished by the dysphagia and by the character of the initial symptoms. In croup there is usually the peculiar cough from the first, or very early, while in abscess there is a period of several days or even weeks before respiration is materially affected.

In abscess backward pressure of the larynx is badly tolerated, greatly increasing the dyspnoea, while in pharyngitis and croup this effect is not so marked. In abscess the horizontal position aggravates the dyspnoea, but not in pharyngitis and croup. The character of the voice will also aid in diagnosing abscess from croup, since in the former it is apt to be nasal, and in the latter hoarse or whispering. The decisive test is afforded by inspection and digital exploration. The tumor is seen, or, if situated too low to be seen, is felt pressing forward the posterior wall of the pharynx.

If the symptoms of abscess are masked by those arising from the cerebro-spinal system, as by convulsions, the priority of the pharyngeal symptoms will serve to aid in determining the true disease.

In a case of suspected abscess the physician should not only carefully inspect the fauces, but should employ digital examination. The finger will sometimes detect fluctuation when no evidence of an abscess is presented to the eye. Two cases observed by Prof. Elliot (*Obstet. Clinic*, p. 420) were examples in point.

PROGNOSIS.—With proper treatment the result is usually

favorable, but if the disease is not recognized, the majority die. In Dr. Allin's cases, of those under the age of twelve years nine died, while ten recovered by the opening of the abscess by the lancet, trocar, or finger, and one by its spontaneous rupture.

If the abscess is due to disease of the spinal column, death may occur even after the sac is opened, the caries of the intervertebral cartilages producing, according to Dr. Allin, dislocation of the vertebrae. Death may also occur, though rarely, from pleuritis, in consequence of the bursting of the abscess into the pleural cavity. Even in cases, if the sac is properly opened, and, if need be, reopened, recovery is possible, as in a case treated by Prof. Post.

TREATMENT.—The proper treatment of retro-pharyngeal abscess is the early and prompt opening of the sac by the finger, the lancet, bistoury, or pharyngotomy. Each method has been successfully employed. That recommended by Dr. Allin is as safe, easy, and effectual as any: "The head of the patient being firmly supported by an assistant, pass the forefinger of the left hand into the mouth, raise the velum palati, and press the point of the finger against the tumor. Then with an ordinary scalpel or bistoury, the blade being covered with adhesive plaster to within half an inch of its extremity, let a free incision be made in the median line, through the posterior wall of the pharynx, into the cavity of the abscess; withdraw the instrument and the operation will be completed." The median line, or a point near it, is selected for the operation in order to avoid wounding the internal carotid. If dyspnoea return, it will be necessary to repeat the operation, as in the case reported by Dr. Post, in which the sac was several times punctured.

Retro-pharyngeal abscess ordinarily requires medical as well as surgical treatment. From the reduced state of the system, and the nature of the disease, tonics are required either ferruginous or vegetable. The nitrate of iron and quinine, or, in strumous cases, the liquor ferri iodidi are eligible preparations. Nourishing diet and often alcoholic stimulants are required.

Oesophagitis.

Disease of the oesophagus in infancy and childhood is comparatively rare. Inflammation is the most frequent disease of this

portion of the digestive tube in these periods, and, indeed, the only one which claims attention. It is most common in infants under the age of three or four months, who are deprived of the breast milk, and are given a diet which is with difficulty digested, and perhaps taken too hot or too cold. It is, therefore, most frequent in foundling hospitals. I have frequently observed it in the infant service of Charity Hospital, and in the Nursery and Child's Hospital of this city, chiefly at the autopsy of young bottle-fed infants, whose symptoms indicated disease or derangement of the digestive function. Many of them had diarrhoea, and died in a state of emaciation. Esophagitis in these cases was associated with stomatitis, especially stomatitis with thrush, or with gastritis, or entero-colitis. Sometimes all these inflammations coexisted. In a few cases the esophagitis was accompanied by the cauliflower growth of thrush, which was found in small hemispherical masses, scarcely as large as a pin's head. Swallowing corrosive or strongly irritating substances, as the acids or alkalies, is an occasional cause of esophagitis. Stomatitis and gastritis commonly occur at the same time.

ANATOMICAL CHARACTERS.—The inflamed surface sometimes presents a uniformly injected appearance. Usually, however, there is greater intensity of inflammation in streaks or patches than over the surface generally. I have frequently observed a greater degree of inflammation in the cardiac portion than in the pharyngeal, even when the infant had stomatitis at the time of its death.

Esophagitis occurring from faulty regimen, or an anti-hygienic management of the infant, is not accompanied by as much thickening of the walls of the tube as often occurs in some other portions of the digestive canal, as, for example, in the colon. In dysenteric inflammation of the esophagus there are more submucous infiltration and thickening than in simple esophagitis.

Occasionally ulcerations of the esophageal mucous membrane are observed in the lower part of the tube, and Billard describes the ulcerative form of esophagitis. At the first autopsies at which I observed these ulcers, I supposed that they were pathological, and indicated a severe grade of inflammation; but a more extended observation has convinced me that they are usually post-mortem, and are not at all dependent on inflammation of the esophagus. The solvent power of the gastric juice not only

cause ulceration in the stomach, but entering the *oesophagus* may and sometimes does produce a solvent action on the mucous tissue there. At the meeting of the London Pathological Society, March 4th, 1852, Dr. Graily Hewitt presented a specimen in which the gastric juice had not only eaten entirely through the coats of the *oesophagus* an inch above the stomach, but had even attacked the left lung. Over the age of six months inflammation of the *oesophagus* is rare.

The symptoms of *oesophagitis* in those young and emaciated infants in whom it ordinarily occurs are not well pronounced. If they have pain in deglutition, or tenderness on pressure over the *oesophagus*, it is not apparent. Nor have they seemed to me to vomit oftener than other infants of this class suffering from indigestion and gastro-enteritis, without *oesophagitis*. It is therefore difficult to diagnose *oesophagitis*. It is, according to my observation, oftener present than absent in spoon-fed infants of three months or under who have persistent stomatitis and enterocolitis.

TREATMENT.—In the *oesophagitis* of foundlings and ill-nourished infants, which arises, as has been stated, from faulty regimen, no treatment is required apart from that designed to relieve the stomatitis or enterocolitis with which it exists. Attention must be directed mainly to the diet and hygienic management. The remedial measures are more fully detailed in our remarks on enterocolitis. *Oesophagitis* produced by swallowing corrosive or highly irritating substances, requires the same treatment as in the adult, namely, poultices, demulcent drinks, perhaps leeches, &c.

CHAPTER VI.

INDIGESTION, CONGESTION OF STOMACH, GASTRITIS, FOLLICULAR GASTRITIS, DIPHTHERITIC GASTRITIS, POST MORTEM DIGESTION, SOFTENING.

INDIGESTION is much more common during infancy than in any other period of life. While the digestive organs in the adult easily assimilate a great variety of food, it is necessary for the

well-being of the infant that its diet be simple and carefully prepared. Departure from this rule leads to indigestion and to various diseases.

After the age of two years, or the period when a mixed diet begins to agree with the organs of digestion, indigestion presents fewer peculiarities than in the infant, approaching in character that of the adult.

Indigestion in some children is habitual; in others the digestive process is ordinarily well performed, but from some temporary derangement of system or error of diet, an acute attack of indigestion occurs. Hence two forms of indigestion may be described; first, acute, referring to temporary attacks; secondly, chronic, referring to the habitual state.

CAUSES.—The causes of indigestion are twofold. First, the condition of the digestive function independently of the aliment; secondly, the unwholesome or improper character of the ingesta. Anything which lowers the vital powers may be a predisposing cause of indigestion by impairing the function of some of the organs which assimilate the food. Impure air and personal uncleanliness, protracted hot weather, and previous disease are among the common predisposing causes. The strong country child can thrive upon a diet which, given to the more feeble child of the city, would produce deleterious results. During the summer months it often happens that an infant in the city cannot digest properly any food given to it except the mother's milk; and from this results much of the infantile sickness and mortality which make this season of the year so much dreaded by parents. There is a natural difference in children, as regards liability to disordered digestion. Some do well upon a diet which given to others similarly situated, occasions vomiting, gastralgia, and flatulence.

In the majority of cases of indigestion, however, the fault does not exist in the child. It is fed too often or irregularly, or upon a diet that is unwholesome or indigestible. It is well known that the milk of the mother or the wet nurse is liable to changes which render it for the time unsuitable for the infant. Her food may be of such a quality, or her mind so excited, or some function of her system so disordered as to effect a temporary change in the constitution of the milk. The occurrence of the catarrhs,

or of gestation, in many who are suckling, has this unfavorable result.

Indigestion is most common in those infants who, deprived of the mother's milk, are intrusted to wet-nurses, or fed from the bottle. The milk of the wet-nurse, from not agreeing with the age of the infant, from irregularity in her mode of life, from the ascendant nature of her food, or from other causes which are not appreciable, may disagree with the infant, and be imperfectly digested.

The most common cause of indigestion in the infant is artificial feeding. This, in the cities, is productive of a great amount of gastric and intestinal derangement and disease. The younger the infant, the less likely is it to thrive if brought up by hand.

Whatever care may be bestowed in the preparation of its food, whether cow's or goat's milk, or farinaceous substances be used, there is seldom that healthy nutrition which is observed in infants who receive the natural aliment. The "swill milk" in common use among the poor families of this city is totally unfit for children of any age, and is apt to produce flatulence, acidity, and indigestion. Acute indigestion occurs in children of any age from food unsuitable in quality or quantity, which produces gastralgia and other symptoms to be detailed hereafter. Those who suffer habitually from mal-assimilation are especially liable to such acute attacks.

In the period of childhood, chronic indigestion is much less frequent than in infancy, but children are, perhaps, more subject than infants to the acute form. This is induced by ingesta taken in too large quantity, or of a kind which is with difficulty digested. Cherries, currants, raisins, the parenchyma of oranges, and lemons, dried fruits and confectionery, which are so often heedlessly given to children, are common causes of acute attacks of indigestion. These substances being but partially digested, or not at all, and sometimes accumulating for days in the stomach or intestines, may lead to a very serious and dangerous condition.

SYMPTOMS.—The *newborn* infant, if the milk continually disagree with it, is fretful. It has a discontented aspect. It seldom smiles, and is not amused by playthings, or is only amused for a short time. Its features are pallid, and bear the appearance of faulty nutrition. Its body and limbs are more or less wasted, or are soft and flabby. Vomiting is frequently present, and some-

times a large mass or masses of cascum are ejected, which have evidently lain a considerable time in the stomach. The bowels may be constipated or loose, and the excretions are unhealthy. This state of the infant continuing prevents the necessary rest of the mother, and may affect unfavorably her health, so as to reduce the quantity of her milk, or render it still more unwholesome.

In addition to the habitual indigestion, these infants sometimes have acute attacks, similar to the acute dyspepsia of adults, and which have been described by writers as gastralgia or enteralgia. Their countenance indicates suffering; they utter sharp cries, and their thighs are drawn over the abdomen, indicating the seat of the suffering. Flatulence is common. By vomiting or an evacuation from the bowels, the offending substance is removed, and the pain subsides.

Indigestion in the *spon-fed* infant is similar to that in the infant who nurses, except that it is ordinarily accompanied by symptoms of greater gravity and persistence, and there is in the *spon-fed* more liability to the acute attacks.

In those who have advanced beyond the age of infancy, chronic indigestion is less frequent than in infants, but as the diet of such children is prepared with less care, and is less restricted, they are very liable to attacks of temporary indigestion. These come on suddenly, and sometimes are so severe as to endanger life. The child, previously well, is suddenly seized with languor; the pulse becomes accelerated, the face flushed, and surface hot. Drowsiness compels him to seek the bed, where he lies with his eyes shut. He sometimes has headache, and a sensation of oppression in the epigastrium. The nervous system is not unfrequently affected, as shown by tenderness of a neuralgic character of the body and limbs, sudden twitching of the limbs precursory of convulsions, and occasionally severe and repeated convulsions. These alarming and really dangerous symptoms speedily subside on the removal of the cause. One of the most severe attacks of epilepsy which I have seen, occurred in a boy eight or ten years old, induced by swallowing the parenchymatous portions of oranges which he had been in the habit of eating, and which had accumulated in the stomach and intestines. The expulsion of the offending substance gave immediate relief.

Sometimes, but not often, the symptoms of acute indigestion

sharply resemble those of pneumonia. For example, an infant, whom I once treated, was seized at night with fever, hurried respiration, and the expiratory moan, which some writers consider pathognomonic of pneumonia or pleuritis. These symptoms subsided when the bowels were freely opened, and currauts, which had been eaten the previous day, were expelled.

As the child advances in years and its general health improves, the digestive function is less frequently disturbed. After the age of three or four years the disease which we are considering becomes one of much less frequency and importance than in infancy and early childhood.

Indigestion leads to some of the most common and serious affections of early life. In the infant, if it continue for any considerable time, mucous inflammation in the mouth, œsophagus, or stomach, or in some part of the intestinal tract ordinarily occurs. In the young infant thrush soon makes its appearance, and whatever the age, the cachexia which results from continued indigestion increases the liability to organic affections. Eclampsia is the most serious, and, at the same time, a frequent result of temporary or acute indigestion.

PROGNOSIS.—In simple indigestion this is good. It is doubtful or unfavorable when ulterior diseases occur, and in proportion to their gravity.

TREATMENT.—The first indication in treatment is obviously the removal of the cause. In *acute* indigestion, when there is reason to believe that there is some offending substance in the stomach or intestines, if the symptoms occur soon after the substance is taken, an emetic may be administered, and *ipoca-uasha*, in syrup or powder, is safe and usually efficient. If several hours have elapsed, a purgative should be given, as castor oil, or calomel, either alone or in combination with rhubarb or jalap.

If the symptoms are urgent, especially if convulsions are threatened, we should not wait for the slow action of a purgative, but should resort to enemata to open the bowels. Sometimes the pain in acute indigestion is such as to require the use of opiates. In the infant there is often an excess of acid in the stomach and intestines, which is best treated by alkaline remedies in combination with the opiate, as in the following mixture:—

R.—Tinct. opii, or liq. opii compos. gr. xij;
Magma calceol. ℞j;
Sacch. alb. ℥j;
Aq. acid. ℥ss.—Misce.

Dose, the bottle being first shaken, one teaspoonful from two to four hours to a child a year old. If there is much pain, it is well to add a little chloroform or Hoffman's anodyne to the mixture.

If in the acute indigestion of infants there is diarrhoea, the camphorated tincture of opium in combination with chalk mixture should be given instead of the above, fifteen drops of the one to a teaspoonful of the other.

In chronic indigestion the means of relief are different. They are twofold: first, as regards change of diet; secondly, measures to improve the digestive function. Spoon-fed infants, suffering from habitual indigestion, require the utmost care as regards the character of their food, its preparation, and the times of feeding. Often it is best, if practicable, to procure a wet-nurse, and sometimes removal to a more salubrious locality is followed at once by improvement in the digestive function. If the infant is already wet-nursed, the milk should be examined microscopically and otherwise, and inquiry should be instituted in reference to the health and diet of the wet-nurse. Sometimes a change of wet-nurse is advisable. For facts and considerations bearing on this point the reader is referred to the chapters relating to regimen.

Infants, as well as children, with chronic indigestion are occasionally much benefited by the moderate and judicious use of alcoholic stimulants. They should be given sparingly with their food, and should be discontinued as soon as the digestive function is fully restored. M. Donné and some other French writers recommend the habitual use of wine for infants even in a state of health, but there are reasons, moral as well as physical, why alcoholic stimulants should only be used as medicines, and never in a state of health.

If the case is one of simple or uncomplicated indigestion, tonics, either the mineral or vegetable, may be employed. In many instances, however, especially in infancy, gastro-intestinal inflammation has supervened, and in such cases those tonics should be employed which exert a favorable, or, at least, not an unfavorable effect on the hyperemic and irritable surface over which they pass.

When indigestion is simple, or accompanied by no serious complication, wine of iron, citrate of quinine and iron, the liquor ferri iodidi may be mentioned among the safe and efficient agents to improve the digestive function. For patients above the age of three or four years I sometimes employ the following formula:—

B.—Ferri sulphat. ʒss;
Acid. nitric ʒss;
Aque ʒvj.—Miser.

In the preparation of this mixture the water should be added last. Four drops may be given three or four times daily, in a little sweetened water, to a child of five years. Nitric acid, I am convinced from observations, has an irritating effect in cases of hyperæmia of the digestive mucous membrane, although it has been given in Hope's mixture for dysentery. I should recommend the above formula, therefore, only in those cases in which there is no febrile excitement, abdominal tenderness, diarrhoea, or other evidence of intestinal congestion or inflammation.

The ferruginous preparations mentioned above are most useful in cases attended by signs of anemia.

Among the useful vegetable stomachics and tonics may be mentioned the compound tincture of cinchona, compound tincture of gentian, infusion of columbo, fluid extract of columbo, and fluid extract of cinchona.

If chronic indigestion is complicated with gastro-intestinal inflammation, subacute or chronic, for this is the form which is usually present, there are still some tonics which may be advantageously administered. Columbo and the compound tincture of cinchona are often useful in these cases, and of the chalybeates wine of iron or the tinctura ferri chloridi, in small doses, may be safely administered. Some physicians employ in cases of chronic diarrhoea accompanied by poor appetite and feebleness of the digestive function, the liquor ferri nitratis, on account of its tonic and supposed astringent properties. I have prescribed it occasionally, but not sufficiently to form a decided opinion in regard to its effects. In the cases in which I have employed it, it was discontinued for other remedies.

I have not alluded to the use of pepsin as a remedial agent in indigestion. The theory of its employment in atonic states of the stomach is good, but physicians in this country have, in most

instances, failed to observe that benefit from its use which they had been led to expect, and which seems to have followed its employment in the practice of some of the European physicians. It is probable that the result might have been better had freer and better preparations of pepsin been prescribed. Boudault's pepsin from Paris has been most used in this country, but in most instances without appreciable benefit. I prescribed it in doses of two or three grains, several times daily, to foundlings from one to three months old in the Infant Service of Charity Hospital, but with a negative result.

Dr. James S. Hawley, of Greenpoint, N. Y., has recently prepared and offers in the shops both a powdered and liquid pepsin, which he claims are superior to imported preparations. He recommends its use not only in simple indigestion, but also combined with subnitrate of bismuth in those cases in which indigestible food has given rise to diarrhoea. To an infant from twelve to eighteen months old he gives five grains of each every three or four hours. Diarrhoea is sometimes checked by the use of these powders, and the patient improves. But further employment is required of the American pepsin, and in an uncombined state, in order to determine its real value. According to Dr. Hawley, alkalies, astringents, and alcohol are incompatible with pepsin. This, if established, is an important fact, since those agents are commonly prescribed in those diarrhoeal affections dependent on indigestion in which the use of pepsin is indicated. They should be administered, if at all, between the doses of pepsin. If alcohol is incompatible with pepsin, it is probable that rectified wine, which some writers recommend, is less reliable than other preparations.¹

Dyspepsia often rapidly disappears by hygienic measures without the use of medicines, as by removal from the city to the country, out-door exercise, or, if the patient is an infant, by being carried into the open air daily. In infants also marked improvement is often observed on the approach of the cool and bracing weather of autumn and winter.

¹ Dr. Hawley's pepsin has been used during the last three months in the Infant's Service, Ward's Island, and the result has been such as to encourage its further employment. Nov. 1868.

Congestion of the Stomach.

Passive congestion of the stomach is described among the diseases of this organ by Billard; but it is a pathological state of little importance in itself. It occurs in new-born infants, asphyxiated at birth and with difficulty resuscitated. In these cases there is generally intense capillary congestion throughout the system. The mucous membrane of the stomach is injected, but not more than that of the mouth or intestines. If circulation and respiration are fully established, this injection of the capillaries subsides. No treatment is required, except measures to promote the circulatory and respiratory functions. In cyanosis and atelectasis there is often general congestion of the capillaries of the systemic circulatory system, on account of the obstruction to the flow of blood through the heart in the one disease and through the lungs in the other. There is in these cases passive congestion of the stomach, but not more than of the other organs.

Gastritis.

Inflammation of the stomach, except when produced by the direct contact of some irritant, is rare in infancy and childhood, independently of disease in some other portion of the intestinal tract. A few cases have, however, been reported in which it was not known that any irritating ingesta had been taken, and in which a careful examination revealed a healthy or nearly healthy state of other portions of the digestive tube. The subjects were, for the most part, young infants. The following is an example related by Billard:—

An infant four days old, remarkable for the color of his face and firmness of flesh, refused the breast and vomited yellow acid matter. On the following day the vomiting had increased: legs oedematous; face pale and pinched; respiration difficult; skin cold; pulse slow and irregular; pressure on the epigastrio region produced cries indicative of pain.

Third day: general sinking; face thin and expressive of great pain; stools natural.

Fourth and fifth days: condition the same. Death occurred on the sixth day, and the autopsy was made on the day following.

With the exception of slight pneumonia no disease was discovered in any part of the system besides the stomach. The mucous membrane of this organ was intensely vascular near the

cardiac orifice and along the lesser curvature. It was also tumefied, and could be easily raised with the nail. In the remainder of this organ there was strongly marked capilliform injection.

This case is interesting as showing what may happen, though rarely. A nursing infant is seized with gastritis without apparently having taken any irritating ingesta, and without other disease of the digestive apparatus. It is probable, however, that in cases like the above, the cause, if ascertained, would be found in the ingesta: perhaps drinks too hot, perhaps elements of colostrum, or pathological elements in the milk, which might produce the disease in young infants in whom the mucous membrane is delicate and sensitive.

Gastritis is not uncommon in infancy in connection with inflammation of the intestines. The latter inflammation is sometimes apparently subordinate to the former, and if such patients die, the fatal result is due mainly to the gastric disease.

CAUSES.—Gastritis, as I have observed it, in infants has been in most cases due in great part to the continued use of improper food, of food not suitable to the age of the child, and which was, therefore, with difficulty digested. Milk, acid or otherwise unwholesome, farinaceous substances, stale, or of an inferior quality, and not properly prepared, drinks too hot or too cold, may be specified among the causes. Therefore this disease is most common in bottle-fed infants, and is comparatively rare in those who receive abundant and wholesome breast milk. Anti-hygienic agencies, apart from the diet, no doubt exert some influence in the production of gastritis as they do of stomatitis. Uncleanliness, residence in damp and dark apartments, and in an atmosphere loaded with noxious gases, produce a condition of system which strongly predisposes to these inflammations, if indeed they may not be enumerated among the direct causes.

Billiet and Barthez have called attention to the fact that certain medicinal substances given to children occasionally cause gastritis. They have observed this effect from the use of tartar emetic, Kermes mineral, and croton oil. Gastritis occurring in this way may or may not be associated with inflammation in contiguous portions of the digestive tube. Elsewhere I have related a case in which gastro-intestinal inflammation occurred in a child nine years old, after having taken a considerable quantity of kerosene oil for spasmodic croup.

Inflammation of the stomach is thought by some to accompany

measles and scarlet fever during the eruptive period, though the proof of this is not decisive. If it occur, it corresponds with the stomatitis and cutaneous inflammation of those diseases, and disappears as they subside. It is mild, and accompanied by few symptoms.

AGE.—From the records of about seventy cases of inflammatory disease of the digestive mucous membrane which I have preserved, it appears that gastritis is rare over the age of six months. On the other hand, it is not uncommon in infants under the age of three months who are deprived of the breast milk. I have met it chiefly in foundlings fed with the bottle, and having at the same time enterocolitis and often also stomatitis and oesophagitis. In these cases there is sometimes continuous or almost continuous infection and thickening of the mucous membrane, from the lips to near the pyloric orifice of the stomach and even beyond this orifice in the intestines. The following is an example of gastritis as it frequently occurs in foundling institutions:—

R. W., female, two weeks old, was admitted into the New York Infant Asylum, August 24th, 1863, anemic and somewhat emaciated. It was in part wet-nursed, and in part bottle-fed. The emaciation increased, and nearly the entire buccal cavity became covered with the conformed growth of thrush. On September 4th, diarrhea commenced. Borax was used for the month, and alkalis and astringents to check the diarrhea, but without material improvement.

The following was the record for September 16th: "Cries almost constantly, with feeble or whining roars; still has thrush; nurses and does not vomit; dejections five or six daily, and green; pulse 136, feeble. Death occurred September 23d.

Autopsy September 25th.—Mouth and fauces not examined; mucous membrane of oesophagus vascular in its whole extent, with slight thickening, but without ulceration; mucous membrane of stomach injected like that of the oesophagus, and somewhat thickened, except in its pyloric extremity, when the appearance was natural, or nearly so; the color in the central part of the inflamed gastric membrane was deep red; no thrush was noticed, except on the buccal surface during life; along the great curvature of the stomach were white flakes, resembling those of thrush, but which were found, by the microscope, to consist mainly of oil globules and epithelial cells, without the cryptogamic formation; mucous membrane of small intestines healthy in their whole extent, except slightly increased vascularity in a few places in the ileum; mucous membrane of colon much injected throughout, except near the ileo-caecal valve, where the vascularity was slight; in the transverse and descending colon, the redness was pretty uniform, and the membrane was thickened, but not ulcerated; solitary glands and Peyer's patches somewhat elevated.

The observations of Valleix show how frequently gastritis is associated with severe attacks of thrush. In twenty-three of his cases of the latter disease, in which the condition of the stomach was noted after death, this organ presented inflammatory lesions in seventeen, and in three others appearances which may or may not have been due to inflammation.

SYMPTOMS.—A difficulty exists in ascertaining the symptoms of gastritis from the fact that this disease is generally connected, as has been already stated, with stomatitis or entero-colitis. Though we may never be able to diagnose this affection as certainly as we can croup or pneumonia, still, there are symptoms which arise directly from the gastritis, and with care we may be able to distinguish them from those symptoms which are due to other pathological states.

If gastritis is acute, pain is present. In the above case from Billard, as well as in a case observed by myself, and related under the head of gelatinous softening, there were frequent cries, and the countenance indicated much suffering, until the stage of collapse. If there is less intensity of inflammation, and the disease is more protracted, the pain is not so severe, and it may be so slight as not to attract attention. Sometimes there is tenderness, so that pressure upon the epigastric region is badly tolerated. Vomiting is regarded as one of the most constant symptoms. The infant after nursing seems in distress till the milk is retained. There is much thirst, so that it nurses with avidity, if it is not too exhausted or feeble. The dejections may be quite regular throughout the disease, as in the case already related from Billard. In the case treated by myself, the evacuations were natural, after one free watery stool, in the beginning of the sickness. There is ordinarily, however, diarrhoea from the presence of entero-colitis. The pulse is sometimes accelerated, and sometimes nearly natural. The emaciation in gastritis is rapid, since not only the milk is in great measure vomited, but the digestive function, so far as the stomach is concerned, is seriously impaired. The features become wrinkled and senile, the eyes hollow, the limbs attenuated, and the cranial bones uneven. Death occurs from exhaustion.

ANATOMICAL CHARACTERS.—Simple gastritis may affect the entire mucous surface of the stomach, or be limited to a certain part. The part which is most likely to escape is that towards

the pyloric orifice. This portion of the organ is sometimes found in nearly or quite the normal state, while the cardiac half or two-thirds are more or less inflamed. The vascularity of the diseased surface is often not uniform. In one place there is simply arborescence; in another intense continuous redness; and between these two extremes, are different grades of vascularity. The mucous membrane is somewhat thickened, softened, and the secretion of mucus increased. Extravasation of blood is not infrequent under the mucous membrane usually in points, and the mucus may be mixed with more or less blood. Small shreds or portions of coagulated milk are often found mixed with the mucus and attached to the gastric surface.

DIAGNOSIS.—In protracted cases, when entero-colitis is present, it is difficult to make a positive diagnosis. Our opinion must then be little more than a plausible conjecture. In the acute attacks we can diagnose the gastritis with more certainty. If a young infant affected with thrush is seized with pain, and it vomits often; if emaciation is rapid, and there is no diarrhoea, or diarrhoea not sufficient to account for the prostration; if the buccal mucous membrane, dotted with the points of thrush, presents a dry appearance and the deep red color of severe stomatitis, there can be little doubt of the presence of gastritis. The diagnosis is rendered more certain by signs of tenderness, when pressure is made upon the epigastric region.

PROGNOSIS.—Like other inflammations, gastritis is probably sometimes so mild that it does not add materially to the suffering or danger of the child. This mild form of the disease under favorable circumstances soon subsides. In other cases by the continuance or increase of the cause, the inflammatory process becomes more severe and extensive, resulting even in disintegration of the mucous membrane. Those cases are especially severe and likely to terminate fatally, which are protracted and accompanied by severe thrush, with a desiccated appearance of the mouth, or with entero-colitis. Pain, vomiting, and rapid emaciation in such children, indicate the speedy approach of death. Improvement in the stomatitis or entero-colitis is a favorable indication, but these inflammations may improve without corresponding improvement in the gastritis.

TREATMENT.—All food or drinks, except those of a bland and non-irritating nature, should be forbidden. If practicable, the

young infant should take no nutriment, except the mother's milk or that of a wet-nurse. As there is an excess of acid in inflammation of the mucous coat of the digestive tube, lime-water may be advantageously given in combination with the breast milk. Opium is required to relieve the pain and quiet the action of the stomach. The camphorated tincture of opium, in doses of four or five drops to a child a month old, or the syrup of poppy, tincture of opium, or liq. opii compositus in proportionate doses, may be administered. If there is thirst, a little gum-water should be given frequently. If there is much emaciation and the vital powers are failing, it will be necessary to resort to the use of stimulants. Stimulating enemata are preferable to stimulants given by the mouth. Much benefit may be anticipated from local measures. Irritation should be produced upon the epigastrium by mustard or other means, followed by fomentations. It is rarely, perhaps never, proper to use leeches, if the patient be a young infant. Death occurs from exhaustion, and it is, therefore, important that the vital powers should not be reduced. If the child is weaned, the diet at first should be restricted to arrowroot, rice-water, barley-water, or similar bland substances. In advanced stages of gastritis, animal broths and jellies may be required.

Follicular Gastritis—Diphtheritic Gastritis.

The pathological character of *follicular* gastritis is similar to that of follicular stomatitis. It is an inflammation affecting the gastric follicles and ending in their ulceration. It is not a frequent disease; it occurs in young infants. Billard observed fifteen cases. The symptoms in these patients were similar to those in simple gastritis of a severe form. The emaciation and prostration were rapid, and death occurred early. We can only diagnose the gastritis without determining its follicular character. How many recover it is impossible to ascertain, but the disease is apt to be fatal on account of the intensity of the inflammation, not only of the follicles but of the intervening mucous membrane. The treatment is that of gastritis.

Diphtheritic gastritis is rare. It occasionally occurs during epidemics of diphtheria. Allusion is elsewhere made to a case treated in the Nursery and Child's Hospital of this city, in De-

ember, 1859. The patient, eighteen months old, previously had had protracted enterocolitis, and died exhausted after a brief attack of diphtheria. There were lesions referable to the enterocolitis, and the body was much emaciated. The diphtheritic exudation was found to cover the fauces, epiglottis, glottis, to the rima glottidis, the entire oesophagus, and almost the entire stomach. The mucous surface underneath was injected; that of the oesophagus and stomach especially was very vascular, softened and thickened, and the submucous-cellular tissue was infiltrated.

The pseudo-membrane taken from the epiglottis and examined under the microscope, presented an amorphous appearance: no cells were noticed in it, and fibrillation was not distinct; that from the stomach was found to consist almost entirely of cells, the plastic corpuscles of some writers, the pyoid of others. The digestive process, so far as the stomach was concerned, had evidently been almost if not entirely suspended, and hence in part the sudden prostration. Diphtheritic gastritis is but a local manifestation of a grave constitutional disease.

Post-Mortem Digestion, Gelatinous Softening, White Softening.

It is now many years since the attention of the profession was directed to disorganization of the coats of the stomach, which is sometimes observed at post-mortem examinations. John Hunter first ascertained that the gastric juice begins to have a solvent effect on the tissues of the stomach soon after death. Though Hunter erred, when he stated that the coats of the stomach are more or less digested in all or nearly all cases, it is certain that post-mortem digestion does take place in many cases, so that a few hours after death the mucous membrane is destroyed to a greater or less extent, and occasionally the stomach is perforated or is even severed from its connection with the oesophagus. I have seen several examples of this post-mortem perforation in infants.

Some of the cases of softening of the stomach reported by older observers, seem to have been such as I have described, namely, cadaveric rather than pathological. Yet there are two other kinds of softening occurring in children, which are strictly pathological, one white softening, the other termed by Cruveilhier gelatinous softening.

WHITE softening of the gastro-intestinal mucous membrane

results from deficient alimentation. It has been observed only in weak and ill-nourished children. The mucous membrane in such loses its firmness, and is easily separated from the subjacent tissue. This disorganization has no connection with any inflammatory process. It is simply a disintegration of the mucous membrane in consequence of the low vitality of the patient, whether or not there are co-operating causes. I believe, that in a large proportion of infants whose systems have been refined and blood impoverished for a considerable time, the gastro-intestinal mucous membrane will be found after death less firm and resisting than in those who have been habitually robust.

A vague opinion exists in the minds of most physicians as to the nature and even appearance of gelatinous softening of the stomach, and the following observations will be cited in order to give a clearer idea of it.

Billard has recorded two cases with his usual minuteness.

The first patient died at the age of three and a half months. When a few days old she had thrush, which was relieved for a time, but returned before death. She was pale and feeble, and became gradually much emaciated. She vomited often, and the features indicated the presence of pain. The record states, "the œsophagus was pale and the stomach of a yellow-white color in its whole extent; but at the greater curvature the mucous membrane was very much stained and white, and so soft that it separated on touching it, in the form of a pulp. Upon pressing this membrane there exuded between the fingers a serous fluid, which, on being received on a watch-glass, coagulated at the end of half an hour, having the same appearance and gelatinous consistence as that on the stomach. The other coats of the stomach appeared as if imbedded in the same fluid, and were ruptured with the greatest ease upon the least force."

The second patient was an infant who died at the age of eighteen days. This case is one of interest, from the fact that M. Baron designated gelatinous softening.

The infant at first had a slight icteric tinge. When three days old it vomited green fluid and passed a large quantity of liquid green feces. On the following day the physiognomy was much altered and the features pinched; the cry frequent and painful; constant movement of features. The vomiting and pain continued till the stage of prostration, which ended in death.

Autopsy.—"Some remains of magnet were found on the tongue and along the œsophagus: the stomach at its great tuberosity presented a gelatinous softening of the mucous membrane to the extent of two inches, which appeared pale and mixed with yellow streaks, and was so tender that it separated upon pouring on it the small stream of water used in washing it. When this was raised the muscular coat—the fibres of which remained whole—formed with the serous coat

the bottom of this disorganization. The circumference of this softening was surrounded by a very red ring or fold formed of the mucous coat, which at this place was not softened, and which when cut appeared as if infiltrated with bloody serum. The remainder of the surface of the stomach presented some irregular red streaks, and in certain parts a very intense capillary injection."

Billard, in his comments on the above cases and other cases which he has observed, says: "What inference shall be drawn from the preceding facts and considerations? None other than that the gelatinous softness of the stomach consists in a disorganization of the mucous membrane of this viscus, caused by an acute or chronic phlegmasia; that this disorganization is characterized by an accumulation of serum in the walls of this organ; the intumescence and gelatinous consistence of the mucous membrane in a part usually circumscribed, situated more frequently in the greater curvature, and about which the membrane exhibits more or less evident traces of an acute or chronic phlegmasia. . . . The softening now under consideration must not be confounded with another kind of softening which does not usually succeed an acute phlegmasia." Billard refers to white softening.

Billard believes that, while gelatinous softening results from gastritis, its proximate cause is an afflux of serum to the part in which the disorganization occurs. In one of the above cases he thinks the inflammation was acute; in the other chronic, and, therefore, showing less vascularity.

West, in speaking of gelatinous softening, says: "Softening of the stomach varies in a degree from a slight diminution in the consistence of the mucous membrane, to a state of complete dissolution of all the tissues of the organ. . . . When the change is not far advanced, the exterior of the stomach presents a perfectly natural appearance, but on laying it open a colorless or slightly brownish tenacious mucus, like the mucilage of quince seeds, is found closely adhering to its interior, over a more or less considerable space at the great end of this organ."

Craveilhier says: "This softening always proceeds from the interior towards the exterior. There is at the beginning simple separation of the fibres by a gelatinous mucus, and in consequence the parietes are thickened and semi-transparent. . . . If the transformation be complete, the disorganized portions are removed layer after layer, those which remain becoming gradually thinner. The peritoneum alone resists for some time, but at

length it is attacked, worn, and gives away, and perforation of the stomach results. The parts thus transformed are colorless, transparent, apparently inorganic, completely deprived of vessels, and exhaling an odor resembling that of milk."

Bouchut remarks: "Softening of the mucous membrane of the stomach in children at the breast is not a special disease which it is necessary to describe by itself. This alteration is always connected with other diseases, and is especially with disease of the large intestine, the knowledge of which fact has been too long neglected. It is the consequence of the acidity of the liquids contained in the digestive tube of young children, liquids which are very acid in the disease we have above referred to."

Dr. Carnwell believes also that there is a pathological softening of the mucous membrane of the stomach, and that when it occurs the symptoms may be those of gastritis or enteritis.

Rokitansky says of gelatinous softening: "If we consider, in addition to the above remarks, the uniform localization of the disease, that in none of its stages it presents, either at the point of the softening or in its vicinity, hyperæmic injection or reddening, and that we are still less able to demonstrate upon the inner surface of the stomach or in the tissue of its coats the products of inflammation, we are constrained to infer the non-inflammatory nature of the affection."

Without extending these extracts, it is seen that the most eminent authorities not only disagree in reference to the cause of gelatinous softening of the stomach, but that they also differ in their description of its appearance. This diversity of opinion is most likely attributable to the fact that the two kinds of softening have been confounded. Rokitansky and Bouchut probably refer to cases of white softening, which is due to a state of lateral feebleness, and, therefore, have concluded that softening of the stomach is not inflammatory. I believe, from my observations, that the opinion of Billard is correct, and that true gelatinous softening is the result of gastric inflammation, sometimes chronic, sometimes acute. But I have seen appearances which led me to think that the immediate causes of gelatinous softening continue to operate after death, so that the amount of softening is often less at the time of death than a few hours subsequently.

The following case, which was watched by myself with great

interest from beginning to end, is an example of inflammatory softening:—

G. S. male, robust, was born July 10th, 1865. The mother not being able to suckle the infant, and the danger of artificial feeding in the warm months being well understood, a wet-nurse was procured. About the 14th of July, this wet-nurse having insufficient milk, another was procured temporarily, who suckled the infant till July 20th, when a third wet-nurse was engaged, whose child, healthy and thriving, was six weeks old. Previously to this time the infant appeared well. It had uniformly nursed vigorously and seemed satisfied.

On the 22d of July, thrush, apparently mild, was observed in the mouth, and a powder, supposed to be borax, and labelled such, was obtained at a drug store, to be used as a wash for the mouth. This powder was afterward ascertained to be alum. About five grains were dissolved in as many teaspoonfuls of water, and the mouth of the child was swabbed occasionally with it. A piece of linen, folded so as to resemble the tip of a nursing bottle, was occasionally dipped into the solution, and the infant was allowed to suck it. The use of the alum was commenced about 6 P. M. In the first part of the evening the infant slept considerably, and of course did not nurse often, but about 8 P. M. it began to be very fretful, and it then nursed more frequently. It vomited once between 8 and 10 o'clock P. M. In order to quiet the infant, the tip soaked in the solution was often applied to the mouth, but there was scarcely any intermission in its crying. Through the night it vomited again once or twice, and about the middle of the night had one free liquid stool, which was passed with much tenesmus. The countenance of the infant was indicative of suffering, and its thighs were repeatedly flexed over the abdomen, as if that were the seat of its distress. Purgative in two-drop doses was several times given through the night, and funnel soaked with hot whiskey was applied to the abdomen.

July 23d. In ignorance of the cause of the child's sickness, another wet-nurse was obtained early in the morning, and one-sixth of a drop of liq. opii compo. was given every hour, with the effect of inducing a little sleep. The tongue was very red, desiccated, and studded with more numerous points of thrush than on the previous day. It now refused to nurse, apparently from soreness of the tongue. At each attempt of the nurse to induce it to take the nipple, it rubbed the mouth across the breast, crying either from pain or disappointment. The alum was not used in the latter part of the night of the 22d, but late in the morning of the 23d it was resumed, the mistake of the druggist not being discovered till midday, when it was estimated that about five grains had been used. Occasionally a little of the solution was placed in the mouth with a spoon so as to be swallowed, in the belief that the thrush affected the œsophagus. The infant continued to suffer much during the day, sleeping at times a few minutes. Its strength was evidently falling; its respiration regular; pulse about 140; its alvine discharges yellow, of natural consistency and frequency.

Evening, 23d. Surface hot; is very restless; pulse 150 to 160;

tongue dry, intensely red, and dotted with points of thromb. Is treated with opiates, a little lime-water, and fomentations.

24th. In the first part of the day nursed pretty well; in the latter part, could be induced to draw the breast only once or twice. The symptoms to-day were the same as yesterday, with the exception of greater emaciation and prostration; cranial bones uneven, and features pinched.

25th. Pulse 140 to 148; strength rapidly falling, but it cries at times loudly. The milk of the nurse, placed in the mouth with a spoon, is often held a considerable time before it is swallowed, and deglutition seems difficult. Respiration in the first part of the day and previously, natural; in the latter part of the day, accelerated; dejections natural; no vomiting; appearance of tongue more natural than yesterday.

26th. Died to-day in a state of collapse at 12½ P. M. The hands were cold several hours before death, and the milk given it was regurgitated.

Autopsy twenty-two hours after death.—Much emaciation; no rigor mortis; cranial bones uneven; upper part of the pharynx injected to the extent of about half an inch; but from this point to the stomach membrane healthy; mucous membrane covering the cardiac two-thirds of the stomach gularous; it had a pink color, and in places had separated from the subjacent tissue; mucous coat of the pyloric third of the organ nearly healthy; along the edge of the softened portion the mucous membrane was vascular to the extent of a few lines; the muscular and serous coats of the stomach underneath the softened portion were easily torn; the mucous membrane of the small intestine presented in places that degree of vascularity known as arborescence; there was no destruction or softening of its mucous membrane; the color was healthy; the stomach was nearly empty; the contents of the small and large intestines were natural in color and consistence; the cæca risera were healthy; in the left pleural cavity was about an ounce of transparent serum, and a less quantity in the right cavity.

It cannot be doubted that the softening in the above case was pathological. The weather at the time was warm, but the infant was placed on ice, and a pan containing ice was kept upon the abdomen. This infant died evidently of gastritis, the accompanying inflammation being subordinate, and in fact insignificant. At first it was a question with me, whether the alum might not have caused the gastritis, so that the case should be properly placed in the category of deaths from swallowing corrosive substances. In order to determine this point, I administered alum daily to two kittens, commencing when they were seven days old. The quantity given to each was ten grains daily in two doses for three consecutive days, and on the two following days five grains. The only uniform result noticed was an in-

crossed flow of saliva, which washed some of the alum from their mouths, and occasionally slight vomiting. There was not even any apparent inflammation of the buccal membrane from the alum.

Cases like the above, and such are recorded by Valleix, show that the opinion of Rokitsansky needs modification, who believes that softening is not the result of inflammation, but a peculiar disease of infancy.

In Valleix's twenty-four cases of what he terms fatal muguet, softening of the mucous membrane of the stomach was one of the most common lesions, and at the same time, which is the point of interest, there were signs which showed conclusively the presence of gastric inflammation. The common coexistence of the lesions of gastric inflammation, such as redness and thickening, with gelatinous softening in other parts of the organ, are certainly most reasonably explained on the supposition that the inflammation preceded, and directly or indirectly caused the softening.

Cases like the above also show that the opinion of Bouchet and some other writers should be modified, who consider gelatinous softening merely a complication of enterocolitis or colitis, and not connected with gastritis.

Whether the opinion of Billard is correct that the proximate cause of this kind of softening is an afflux of serum, or of Bouchet, that it is an excess of acid, is uncertain.

It has been said that M. Baron was able to diagnose gelatinous softening. The symptoms are those of the severer forms of gastritis. The vomiting, great pain, restlessness, sudden and progressive emaciation, and, finally, collapse preceding the fatal result, are the symptoms on which the diagnosis is based. The treatment should be directed to the gastritis.

CHAPTER VII.

NON-INFLAMMATORY DIARRHŒA.

DIARRHŒA is frequent during the whole period of infancy. The French writers describe several varieties according to the character of the evacuations, as *assuet*, *muqueuse*, and *serueuse*.

M. Rostan even describes fourteen distinct kinds. But the tendency of medical science in these modern times is to simplify the nomenclature of diseases—to describe under a single name those affections which are essentially the same though differing somewhat in their features. Now all the forms of diarrhoea in the infant may be so grouped as to reduce the number to not more than three or four. In this way repetition and prolixity are avoided as well as an unnecessary refinement.

Non-Inflammatory Diarrhoea.

The most common and the simplest form of diarrhoea is that enumerated in *our* heading. Though attended often by an anatomical alteration in the intestines, the inflammatory character is absent. This disease is described by some writers as simple, or catarrhal, or spasmodic diarrhoea. Many cases of diarrhoea supposed to be non-inflammatory are really cases of enterocolitis, and very frequently diarrhoea not inflammatory in its commencement changes its character and becomes such. This is especially true of such diarrhoeal affections as are produced by improper diet.

CAUSES.—The causes of non-inflammatory diarrhoea are various. Influences, which in the adult would have no appreciable effect, increase the number of evacuations in the infant.

A common cause is food of unsuitable quality or quantity. Food that does not digest well is apt to stimulate the intestinal follicles to excessive secretion or to accelerate the peristaltic action of the intestines. In infants diarrhoea is sometimes due to too frequent feeding. Many whose stomachs are overloaded obtain relief by vomiting, but others do not. The food not needed for nutrition serves as an irritant, and produces green and unhealthy evacuations. Dr. James Jackson, in his letters to a young physician, calls attention to this cause of diarrhoea.

The mother's milk or the milk of the wet-nurse may disagree, either from some temporary derangement of her system, or continued ill-health, or occasionally from causes which are not understood. Non-inflammatory diarrhoea in the nursing is the immediate result, but inflammation may afterwards occur. The milk in these cases frequently contains the elements of coagulium.

Fright or strong mental impressions will also in some children

increase the number of evacuations. This cause being transient, the diarrhœa soon subsides.

Another cause is exposure to cold. Children who are insufficiently clothed in the winter season, who are taken from a heated room into a cool room without sufficient precaution, or who lie uncovered at night, are very subject to diarrhœal attacks from the impression of cold on the system.

The cause of non-inflammatory diarrhœa may exist in the child itself. In some children the evolution of the teeth is attended by a relaxed state of the bowels, which ceases when the gum is pierced. Worms in the intestines may also operate as a cause. Diarrhœa is occasionally salutary within certain limits, and of course it is not strictly correct to call it a disease when it is a means of relief. If occurring from an excess of food or from dentition, it may prevent convulsive seizures.

Symptoms.—Non-inflammatory diarrhœa sometimes comes on suddenly; at other times there are precursory symptoms continuing for some days. Whether or not there are antecedent symptoms depends chiefly on the cause. If diarrhœa occur from fright, or from cold, or from improper aliment, it commonly occurs immediately. If from painful dentition, there are previous symptoms referable to the eruption of the teeth.

The prodromic symptoms are restlessness and disturbed sleep; sometimes the physalgœmy indicates transient abdominal pain. Indigestion characterized by regurgitation, nausea, or even vomiting, is an occasional premonitory condition. Finally, diarrhœa commences. The evacuations differ much in color and consistence in different cases, and perhaps at different periods in the same case. In infants they are apt to be green. This color, which is a source of anxiety to the inexperienced, and especially to the parents, is often produced by trivial causes. Slight indigestion will produce it. So will excess of food, even the most bland and unirritating. Occasionally the stools consist in part of undigested portions of food, especially the casein. In children advanced beyond the period of first dentition the evacuations do not differ materially in appearance from those occurring in the adult. The stools are usually passed easily, but there is sometimes in infants more or less tenesmus, if they are acid or in any way irritating. Occasionally there is a sensation of fulness in the abdomen.

In the form of diarrhœa which has been designated *acrescent*,

not only is there an acid odor and reaction of the matter vomited, but also of the stools. At night, since less nutriment is taken, and the patient is more quiet, the evacuations are less frequent. If the complaint is slight, there is little desire for drink, but if the stools are frequent and thin, especially if they approach the serous character, thirst is often intense; the appetite varies; the tongue is moist, and covered with a light fur; there is often more or less meteorism, but no abdominal tenderness.

The face in non-inflammatory diarrhœa is pale. If the disease continue, in a few days there is evident loss of weight and flesh. The rotundity of the limbs is gradually lost, and the tissues become soft and flabby. But in most cases, when the affection has reached this stage, its original character is lost, and it has become inflammatory.

There is no constant fever in true non-inflammatory diarrhœa. Sometimes the pulse is accelerated in the latter part of the day, but usually only for a short time.

Certain epiphenomena, as Barrier terms them, occur at times in non-inflammatory as well as in inflammatory diarrhœa, for example a sympathetic cough, or, which is more serious, cerebral complications. Convulsions or stupor indicating the supervention of spurious hydrocephalus may occur in either form of diarrhœa. This disease is described elsewhere.

ANATOMICAL CHARACTERS.—The structural changes observed in the intestines in those who die of non-inflammatory diarrhœa have been well described by Billard. "I have seen," says he, "isolated follicles, and follicular plexuses of the intestinal tube, in considerable numbers, and developed without being inflamed, in twelve infants. There were three aged from eight days to three weeks; two aged two months; the remaining seven were from nine months to one year. The follicles appear at the commencement of dentition. Ten of these children were affected with diarrhœa of liquid, white mucous matters. This is really the serous diarrhœa of authors; and every symptom leads to the belief that there is a direct relation between the development of these follicles, and the augmentation of their secretion." . . . "I do not consider this morbid development of the muciparous follicles as a true inflammation. Nevertheless, this state of excitability which causes the augmentation of their secretion is, as it were, an intermediate stage between the normal state and the

state of inflammation." Barrier's views also coincide in the main with those of Billard.

One of the most common lesions observed in the intestines, in those who have died with non-inflammatory diarrhoea, is, as these authors remark, turgescence of the intestinal glands. In a large proportion of cases these glands will be found more distinct than in the healthy state.

The solitary follicles of the large intestines, especially, are, in most cases, elevated, and their central depression distinct, and the patches of Peyer are also prominent.

The following is an example of non-inflammatory diarrhoea in a young infant:—

On the 7th of July, 1865, a foundling, one month old, died at the Infant Asylum. It was much emaciated, with eyes sunken and features pinched, at the time of its death. It was wet-nursed towards the close of its life, but the nurse's milk was inefficient. It did not vomit; did not have any marked acceleration of pulse (128 per minute), and its evacuations were about four daily, and thin. The stomach and intestines were pale throughout. The solitary glands, particularly those in the colon, and the patches of Peyer were tumefied so as to be visible, and somewhat raised above the surrounding surface. There was probably slight thickening of the mucous membrane, and tumefaction of the muciparous follicles, but these changes were not clearly ascertained.

Diagnosis.—The only disease with which there is liability of confounding non-inflammatory diarrhoea, is enteritis or enterocolitis. From these it may be distinguished by the absence of continued fever, and of abdominal tenderness. Sometimes, indeed, it is difficult to say whether the case is non-inflammatory, or whether there exists a moderate degree of inflammation, though practically the determination of this point is not important.

Prognosis.—In a large proportion of cases, non-inflammatory diarrhoea is not dangerous. With the adoption of suitable measures to remove the cause, and the use of medicines to control the discharges, the patient recovers. The remark already made may be repeated here that occasionally diarrhoea is salutary within certain limits, as when there is a foreign substance in the intestines, either irritating mechanically or by its chemical properties, and which the diarrhoea serves to remove.

The danger, in non-inflammatory diarrhoea, arises from con-

plethoria, as spurious hydrocephalus, or from the emaciation and exhaustion. There may also be danger of its eventuating in inflammation which is always serious. Whether or not the diarrhœa is in itself injurious to the child, and a source of danger may be determined by observing whether or not there is emaciation.

If the rotundity of the figure and firmness of the tissues are preserved, showing that alimencation is still sufficient, and no complication arises, the diarrhœa is not as a rule injurious. In infants that over-nurse and do not vomit the surplus milk, the evacuations are sometimes green and frequent, and yet fulness of figure is preserved, and the development of the body proceeds as usual. The same state is sometimes observed in the diarrhœa accompanying dentition. In these instances a moderately relaxed state of the bowels is not injurious. On the other hand, diarrhœa attended by emaciation or softness or flabbiness of the flesh requires immediate treatment. Many lives are lost by the neglect of such patients, till they are so reduced that they can no longer derive any material benefit from remedial resources. This fatal neglect is common during the process of dentition.

TREATMENT.—It is necessary, in order to treat successfully diarrhœa in infancy and childhood, to ascertain the cause, and, so far as possible, to remove it. It is not till the cause ceases to operate, that we can expect a satisfactory result from medication. The disease may be temporarily relieved by medicine, but it usually returns at once when treatment is omitted, unless the patient is removed from the influence of the agencies which produce it. These remarks are especially applicable to the diarrhœa of infants. With them very generally, when affected with this complaint, there is some fault as regards the quantity or quality of food. Attention to this matter will show the need of a change of wet-nurse, or if the infant be spoon-fed, a change in the character of its food or the mode of preparation, or even in the quantity given. In many cases, by change in the diet, and by the adoption of hygienic measures, the complaint ceases so as to require no medication. If medicines are needed, and the symptoms are not urgent, it is occasionally advantageous to commence treatment by the use of some of the milder purgatives in small doses. In the *case* in which the dejections are so generally acid, an alkaline laxative, or a laxative combined with an alkali, often has a good effect as preliminary treatment. Half a

teaspoonful, to one teaspoonful of castor oil, or a proportionate dose of Rochelle salts, removes any acid or irritating substance from the intestines, and is followed by a diminution in the number of stools. The improvement, however, without subsequent treatment, is usually only for a day or two. The use of a purgative should therefore be considered as preliminary to other measures. In this city a purgative dose of castor oil is often given as a domestic remedy in infantile diarrhoea, the beneficial effect from it having popularized its use for this purpose. Trouessart usually gave Rochelle salts.

If there has been previous constipation and the diarrhoea has just commenced, a purgative is obviously indicated. With the operation of this medicine there is frequently marked improvement. West says: "Provided there be neither much pain nor much tenesmus, and the evacuations, though watery, are fecal, and contain little mucus and no blood, very small doses of the sulphate of magnesia and tincture of rhubarb have seemed to me more useful than any other remedy:—

R.—Magnesia sulphatis ℥i;
Tinct. rhei ℥i;
Syr. simplioris ℥j;
Aqua cam. ꝑss.—M.

℥j or ʒss for children one year old,

and I seldom fail to observe from it a speedy diminution in the frequency of the action of the bowels, and a return of the natural character of the evacuations."

In diarrhoea of infants, due to indigestion, and attended by acidity, the following prescription is sometimes useful. By improving digestion and correcting acidity, it has a beneficial effect on the diarrhoea. The cases are, however, in my experience exceptional in which this is the proper remedy.

R.—Pulv. ipecacuanha gr. ʒ;
Pulv. rhei gr. ij;
Soda bicarb. gr. iv-vi.—M.

Divide in chart. No. xij. One powder every six to six hours to an infant one year old.

The effect of laxative medicines, employed for the purpose of correcting the functions of the gastro-intestinal surface is uncertain. If there is no improvement from their use within two or three days, they should be omitted. We must rely on astringents, opiates, and, in infants, also on alkalies. If the symptoms

are urgent, if the evacuations are frequent and exhaustive, these agents should be employed from the first. Much harm is often done, and precious time lost, by prescribing laxative mixtures when opiates and astringents are required. I have known them to aggravate the complaint, when, by change of measure, there was immediate improvement. The majority of cases of non-inflammatory diarrhoea, at the period when the physician is called, are best treated by the use of astringents and opiates exclusively, proper directions at the same time being given in reference to the diet and hygienic management.

In the diarrhoea of infants the compound powder of chalk and opium is an excellent medicine, containing, as it does, an astringent with the opiate and alkali. It may be given, in doses of two to three grains, to a child one year old, every three or even two hours. The following is an old, but efficient prescription in the simple diarrhoea of infants:—

R.—Tinct. opii camphorat.,
Tinct. catechu, ʒi ʒij;
Mistur. roseæ ʒj.—M.

Dose, one teaspoonful every two to four hours to a child one year old.

If there is no acidity of the evacuation, the following mixture will often be found effectual, which is similar to one recommended by Dr. West:—

R.—Acid. tartaric, gr. xij;
Tinct. opii gutt. xij;
Tinct. cinnamon. comp. ʒij;
Sacch. alb. ʒss;
Aq. cinnamon. ʒv.—M.

Dose, one teaspoonful every two or three hours, or larger time, according to the evacuations.

Kino, krameria, or 'logwood may be used in place of the astringents mentioned above. If the diarrhoea is due to the feeble digestive powers of the patient, and its food is therefore irritating, powders of pepsin and subnitrate of bismuth have seemed to me more beneficial than any other medicinal agents for young patients.¹

In the treatment of non-inflammatory diarrhoea occurring in infancy, it is rarely necessary to use the mineral astringents, as acetate of lead or nitrate of silver. If the patient is not relieved by opiates, alkalies, and the vegetable astringents, and by proper regimen, in all probability there is inflammation of the intestinal

¹ See remarks on the treatment of Indigestion.

mucous membrane. In patients over the age of two or three years, simple diarrhoea approaches in character that of the adult, and the treatment appropriate for the adult is proper in these cases, allowance being made for the difference of age. In infants, in whom this disease, if protracted, is very liable to eventuate in spurious hydrocephalus, stimulants are often required at an early period, on account of the prostration and the feeble power of endurance of the patient.

CHAPTER VIII.

INTESTINAL INFLAMMATION OF INFANCY.

It is customary with writers to treat of inflammation of the small and large intestines in infancy as a single disease, for the following reasons: first, the symptoms of colitis, at this period of life, do not ordinarily differ, in any marked degree, from those of enteritis. The tormina, tenesmus, and abdominal tenderness, which characterize colitis in childhood and adult life, are lacking, or are not appreciable by the observer; and the mucosanguineous evacuations are oftener absent than present. On account of this absence of symptoms, Bouchut says: "Dysentery is a very rare disease amongst young children. Its existence might even be denied, if it had not been observed at the period of some severe epidemics of dysentery." If Bouchut refers, by the term dysentery, to the ordinary phenomena of that disease, his remark is correct; but, as regards the lesions, it is erroneous, for colitis is not so rare in infancy as his remark implies. Billard, after analysing eighty cases of intestinal inflammation in infants, says: "From this calculation, it is evidently very difficult to make a correct diagnosis of inflammation of the intestinal tube in sickening infants, yet it would seem as if the proper signs of enteritis or ileitis were the rapid tympanitis of the abdomen; the diarrhoea, accompanied with vomiting; while in colitis, diarrhoea alone, without tympanitis, is the most frequent." And again: "In consequence of the impossibility we have found to exist of tracing with exactitude the series of symptoms proper to

inflammation of the different portions of the digestive tube, we shall content ourselves with presenting an analytical sketch of the causes, symptoms, and ordinary course of inflammation of the mucous membrane of the intestines in general."

The frequent absence of any pathognomonic symptom or sign by which to determine the exact seat of intestinal inflammation in the infant, is admitted by recent observers as well as Ballard.

The second reason why intestinal inflammation in the infant is described as a single disease is, that enteritis and colitis are in the majority of cases coexistent. This will be seen when we come to speak of the anatomical characters.

I have hesitated in selecting a term for this inflammation. The expression "inflammatory diarrhoea," used by West, is objectionable, because it designates a disease by a symptom when there are well-marked lesions. To the expression, entero-colitis, employed by Bouchut, Meigs, and others, there is this objection, that sometimes the disease is only enteritis, and sometimes colitis; whereas entero-colitis would imply the presence of both inflammation of the small and the large intestines. Barrier uses the expression gastro-intestinal inflammation, but in a large proportion of cases, gastric inflammation is absent. I have treated of gastritis as an independent affection, and it seems proper to exclude it from our description of the intestinal disease, except as a complication.

Although I prefer the term intestinal inflammation, I shall use, in describing the disease, the expressions inflammatory diarrhoea, and entero-colitis, as synonymous, in order to avoid too frequent repetition of words.

Intestinal inflammation is one of the most common and fatal of infantile diseases. It is the great summer epidemic of the cities, in this country. Unfortunately for a correct understanding of its prevalence and mortality in this city and perhaps elsewhere, it is very generally in the summer months when obstinate, and especially when fatal, called cholera infantum, although, in its symptoms and nature, it is very different from that disease.

Intestinal inflammation is often a protracted complaint, having ordinarily a mild commencement, while the true cholera infantum begins abruptly, is characterized by violent symptoms and rapid and extreme exhaustion. The two diseases are, however, often associated as cause and effect.

The 1500 fatal cases of so-called cholera infantum, reported every summer in this city, are, with now and then an exception, cases of inflammation, generally protracted. In like manner, the excess of reported cases of infantile marasmus, in the second half of the year, over those reported in the first half, should be added to the statistics of intestinal inflammation. This excess, which is noticed every year in the mortuary tables of this city, is due mainly to the death of those wasted infants who have lingered with enterocolitis from the summer months. Their marasmus is simply a result of the protracted inflammation.

CAUSES.—Inflammatory disease of the intestines in infancy, I have said, is chiefly a summer affection—at least, in the cities. Occasionally it is observed in the winter, and it is then, when not due to error of diet, produced by exposure to cold. Infants who are taken from warm to cold rooms, or into the open air, by heedless nurses, or who sleep uncovered at night, are especially liable to this disease. Enterocolitis, produced by this cause, occurs both in the country and city.

In these cases the inflammatory process may not commence suddenly. There is often a premonitory stage of simple diarrhoea, the first effect of the impression of cold. Indeed, in a very large proportion of cases, whatever the cause, non-inflammatory precedes inflammatory diarrhoea.

The influence of the summer season in the production of this disease is forcibly shown by the death statistics of this city. Thus for the five years ending with 1893, there were 6379 deaths reported from cholera infantum, and of these all but 166 occurred in the months from June to October inclusive. The deaths reported for the same years from diarrhoea, dysentery, and inflammation of the bowels, were 5914, of which 3919 occurred in the months from June to October. Of the 3914, the number under the age of five years was 3257.

Those familiar with the diseases of this city, and especially with the autopsies of infants, will agree that four-fifths of the above cases which were reported as cholera infantum, or diarrhoea, were cases of intestinal inflammation. There is no one disease, except consumption, so prevalent and fatal in this city as infantile enterocolitis during the period of its epidemic occurrence in the summer months.

The epidemic commences about the middle of May. From this

time there is a gradual increase in the number affected, till the months of July and August, when the disease attains its maximum prevalence and mortality. During the months of September and October, the number of seizures and of deaths gradually abates till the epidemic character is lost. It is thus seen that the prevalence of intestinal inflammation of infancy in the city bears a close relation to the degree of summer heat. That the high temperature of summer is not in itself sufficient to produce enterocolitis is, however, obvious. In elevated localities in the country there may be intense and long-continued heat, and yet in such places intestinal inflammation of infants is not common. It is no doubt the noxious exhalations from various sources with which the atmosphere is loaded, as a consequence of the heat, which render the disease so prevalent in certain localities in the summer months. The exact character of these exhalations or vapors is not fully known, but the following facts are clearly established by many observations.

Enterocolitis prevails most on low grounds near the sea shore. Thus, it is common in many parts of Long Island, on Staten Island, and on the flats of Westchester County. Experienced and observing physicians of this city do not send infants affected in the summer months with enterocolitis to these localities, but to the high grounds west of the Hudson, and to the hilly parts of New Jersey, where there is comparative immunity from the disease, and recovery is more certain and speedy.

But the state of atmosphere which is most favorable for the development of enterocolitis is found only in the cities. The filthy streets containing more or less decaying animal and vegetable matter, the crowded and unclean tenement houses, the neglected privies, the slaughter houses, pig-pens, bone-boiling establishments, and the like, are so many sources of the most deleterious effluvia, which, inspired by the infant, produce diarrhea and intestinal inflammation. Those squares of the city where sanitary regulations are most neglected, are the very ones where the mortality from this cause is largest.

In the year 1864 the Unionist Association of the City of New York effected a complete and thorough sanitary inspection of New York Island and it was interesting as well as painful to note the facts observed by the inspectors in reference to the prevalence of the so-called cholera infantum (chiefly enterocolitis) along the

streets and in the alleys where the causes of insalubrity were most abundant.

Thus one inspector says of this disease, it "has probably consigned many more to the grave during the past summer than all other diseases in my inspection district. In every case examined, I have found it associated with some well-marked source of insalubrity. Vegetable and animal decomposition has been the most prominent cause." Another inspector says of the same disease: "It was found between the — and — avenues, where the street, at every visit, was found in an indescribably filthy state, in consequence of deposits of garbage and slops. This was particularly noticed in front of the premises where cholera infantum had occurred. "Such was the uniform testimony of all the inspectors. In the tenement houses and in portions of the city, occupied by the poor, where the sources of insalubrity are most numerous, I believe from personal observation, that a majority of the infants are more or less affected with diarrhoea often of an inflammatory character, during the months of July, August, and September. In the more salubrious localities of the city there is less of this disease, but even here the liability to it is great, on account of the proximity of so many sources of impure air.

But there is another and an important element in the causation of intestinal inflammation in the infant. I refer to the diet. Many an infant that now falls a victim would escape the disease, but for some fault in the character of its food. Those infants in the city who are bottle-fed from birth, rarely go through the summer without being affected with diarrhoea, and a majority of such, if under the age of six months, when the warm weather commences, are saved from dangerous, if not fatal inflammation only by removal to the pure air of the country.

In the families of the poor the food which is given as a substitute for the mother's milk is very apt to disagree with the feeble digestive powers of the infant. The swill milk, about which so much has been said and written, is in common use in this city among these people, or has been till recently. This milk, in the proportion of its ingredients, and sometimes even in its chemical character is very different from the milk of healthy, and well-fed cows of the country. Infants to whom this milk, and other improper articles of diet are given, are the first to suffer with diarrhoea as warm weather commences, and finally with enterocolitis.

It is seen that the causes of intestinal inflammation of infancy as it prevails in the cities during the summer, are mainly twofold, atmospheric and dietetic—an insalubrious state of the air which the infant breathes, and unsuitable food. Among the poor of the cities, both these causes conspire to produce the diarrhoeal maladies. It is easy then to see why there is so much intestinal disease, and so great mortality among the infants of the city poor. Moreover, on account of their feeble powers of resistance and endurance they are especially liable to be affected by morbid agencies.

It is a common belief in the profession that dentition is one of the chief causes of diarrhoea in the infant, whether inflammatory or non-inflammatory.

There is, indeed, great liability to this disease during the period of dental evolution. The following statistics which were mostly collected during my term of service in one of the city dispensaries, and which comprise all the cases of diarrhoea under the age of about five years which were brought into that institution for treatment, during the summer months of my attendance, show the preponderance of cases in the time of teething. Most of these cases were apparently inflammatory.

Stage of Dentition	No. of Cases
No teeth	47
Cutting incisors	106
" eruptive molars	41
" canines	39
" 1st molars	30
Having all the teeth	28
Total	292

It is seen that although a large majority of the above cases occurred during dental evolution, yet in a certain proportion, about one in four, teething could not operate as a cause. My own opinion is that dentition is an occasional cause of simple diarrhoea though a subordinate one, but evidence is wanting that it is sufficient of itself to produce inflammation. The diarrhoea of dentition is probably non-inflammatory, terminating in inflammation, if such a result follow by the co-operation of other and distinct causes. This subject is treated of in our remarks relative to dentition.

An important predisposing cause of intestinal inflammation in infants is the rapid development of the intestinal crypts, and follicles. This development, which increases the liability to organic diseases of the intestines, is coincident with dentition.

Another important cause remains to be noticed, namely, weaning. Weaning is a subject to which less attention is given than its importance demands. The summer succeeding the change of diet is always in the city a time of great danger to the infant from diarrhoeal affections. Mothers uniformly speak with dread of the second summer. In this city, nearly every infant taken from the breast between the months of April and October, very soon becomes affected with diarrhoea, which if not inflammatory in its commencement soon becomes such. Weaning in the cool months involves less danger, but even then the succeeding summer is one of peril. I have memoranda of the time of weaning in forty-six infants who were affected with diarrhoea, apparently from its duration and obstinacy of an inflammatory character.

Weaned in spring or summer	25
" " autumn or winter	11
	<hr/> 36

The reader is referred for other particulars in reference to weaning, to the chapter devoted to this subject.

The above facts and statistics, to which more might be added, suffice to show the causative relation of foul atmosphere and injudicious feeding to the intestinal inflammation of infancy.

Intestinal inflammation also occurs as a complication of certain diseases, especially the eruptive fevers. It is the opinion of some, that in measles and scarlatina, there is mild inflammation of the intestinal mucous membrane, coexisting with the eruption upon the skin, and disappearing with it. But in a proportion of cases, most frequently in measles, a more intense inflammation arises, constituting a serious complication. The peculiar intestinal inflammation in typhoid fever is well known.

AGE.—My observations in reference to the age at which this disease occurs, were made in the summer months, and, therefore, relate to the summer epidemic. The cases embraced in the following table, were nearly all observed between the months of May and October inclusive:—

Age.	No. of Cases.
5 months or under	58
From 5 months to 12	219
" 12 " " 18	174
" 18 " " 24	81
" 24 " " 36	92
Total	<hr/> 524

This table shows that the infant under the age of six months is less liable to enterocolitis than between the ages of six months and two years. The small comparative number, however, affected under the age of six months, I attribute to the fact that most of the infants under this age were wet-nursed. Observations made in the institutions of this city, in which foundlings are or have been received, show that the younger the infant is, the more liable it is to be affected with this disease, under unfavorable conditions of atmosphere and diet. Thus, in the infant's service of Charity Hospital, prior to the adoption of wet-nursing, a large proportion of the foundlings received, died of well-marked enterocolitis in the first and second months, and very few lived till the age of six months. A similar fact was observed in the N. Y. Infant Asylum. During my term of service in this institution I preserved notes of forty-nine fatal cases, which I diagnosed enterocolitis, and in many of which post-mortem examinations were made. Of these cases, eighteen were one month old or under, fifteen from one month to three, eight from three to six, and only eight over the age of six months.

SYMPTOMS.—Intestinal inflammation in the infant usually commences with moderate diarrhoea. At first there may be no anatomical alteration of the mucous membrane, except simple turgescence. The number of evacuations at this period frequently does not exceed four to six daily. The disease often begins with more or less fretfulness and febrile reaction. The color and consistence of the dejections vary. The color is sometimes yellow at this early stage of the disease, and sometimes green, especially in young infants. Whatever the color or appearance of the stools, there is great uniformity in one respect, and that is their acidity. Litmus paper is reddened by them, and they have a decidedly acid odor.

In a few days, the disease continuing, a new symptom arises. The infant now begins to vomit. This symptom I found from observations made in 1863 and 1864 in the summer enterocolitis of infants, commences in less than a week in the majority of cases, though the time varies greatly. In consequence of the vomiting and diarrhoea, the patient becomes pallid, the flesh soft and flabby, and soon there is evident emaciation. If there is fretfulness in the beginning of the sickness, it now ceases, and the patient lies quiet, having an exhausted appearance. As the

disease advances the features become pinched and wrinkled. The hollowness of the cheeks and sunken state of the eyes are in striking contrast with the appearance presented before the inflammation commenced. So feeble is the muscular tonicity in advanced cases, that during sleep the mouth and eyes continue open.

In the beginning of the sickness the tongue is moist and covered with a light fur. At a more advanced stage it is dry, and in dangerous forms of the disease the buccal membrane is red, the gums swollen, and sometimes ulcerated, and in young children thrush is apt to appear.

Vomiting commencing, as I have said, at a later period than the diarrhoea, continues unless relieved by medication or a favorable change of the disease. It is sometimes very intractable. It is connected with acidity, and seems to be partially due to it, except occasionally in the last stages of the inflammation. The substance vomited has a sour odor, and produces a decided reaction with litmus paper. It contains coagulated casein and undigested particles of whatever food has been given. When the vital powers are much reduced and a fatal result approaches, this symptom is often connected with cerebral congestion.

The stools sometimes continue during the whole course of the enterocolitis, of nearly the same character as at first. In other cases they vary at different periods in color as well as consistency. They sometimes have a putty-like appearance from the partly digested casein; at other times they are brown and offensive. A very common appearance is that which has been likened to spinach or chopped vegetables; occasionally the stools consist largely of mucus, with perhaps a little blood—the mucous diarrhoea of Barrier. This occurs when colitis is a principal part of the disease. The evacuations are seldom so watery as in true cholera infantum.

Sometimes the stools are yellow when passed, but become green on exposure to the air, or from chemical reaction resulting from admixture of the urine. The reader is referred to Part II. for farther remarks in reference to the green alvine evacuations in infancy.

The microscopic character of the stools in enterocolitis is interesting. Aside from undigested casein, I have found fibres

of meal unaltered, crystalline formations, epithelial cells, single or arranged regularly in clusters, as if detached from the villi—mucus, sometimes blood, and, in one case, an appearance resembling three or four crypts of Læberkuhn united. If the stools are green, colored masses of various sizes, but mostly small, are also seen with the microscope. The microscopic elements, then, are the excrementitious substances, particles of undigested food, inflammatory products, and epithelial cells or fragments of the mucous membrane, thrown off by the inflammatory process. The pulse in enterocolitis is accelerated. There is frequently increased heat of surface in the commencement, but, as the disease continues, the vital powers soon become reduced, and the surface is either of the natural temperature or cool. As death approaches, the pulse gradually becomes more frequent and feeble, and the extremities, sometimes for hours before life is extinct, have a cadaverous pallor and coldness. The skin, in intestinal inflammation, is generally dry, and the urinary secretion diminished. In severer forms of the disease, attended by frequent evacuations from the bowels, the infant does not pass its urine oftener than once or twice daily. The imperfect action of the skin and kidneys is a noteworthy feature of the inflammation. The advanced stages of enterocolitis are apt to be complicated by two cutaneous affections, namely, erythema between the thighs, probably produced by the acid and irritating character of the stools, and boils upon the forehead and scalp. The last extend sometimes down to the pericranium, and leave permanent depressed cicatrices. The external irritation caused by the furuncular affection has seemed to me sometimes conservative, as it occurs at the time when there is danger of passive congestion of the brain and serous effusion. When enterocolitis is protracted, and the patient is much reduced, remaining constantly in the recumbent position, except when held in the arms of the mother or nurse, another symptom frequently arises, namely, a dry cough, which continues till the close of life, if the case be fatal, and subsides slowly if the disease terminate favorably. The complication which gives rise to this symptom will be considered hereafter. As death approaches, the infant sometimes becomes more fretful; it turns pervisely from playthings, rolls its head, or the head has an unsteady movement; and sometimes the stomach is more irritable. The experienced physician rightly interprets these

symptoms as the forerunner of cerebral accidents. In other cases there is too great prostration even for the exhibition of restlessness, and the infant lies quiet. As death approaches, the infant becomes drowsy. The limbs are cool. It refuses to nurse, or, if spoon-fed, takes nutriment apparently without relish. The pupils are contracted, and insensible to light. The eyes are closed, and a purulent secretion occasionally collects between the lids. The stools are less frequent, and the vomiting, if previously present, ceases. Death occurs quietly.

Sometimes, however, convulsive movements precede death, generally slight, as of one arm, or of the limbs on one side. Uremia may be the immediate cause of death in certain cases.

In chronic enterocolitis there is extreme emaciation for a considerable time before death. The skin of the extremities lies in wrinkles; the joints, from contract, appear enlarged, and the fingers and toes elongated; the angular projections of the bones are prominent. The hollowiness of the cheeks and eyes causes the infant to appear much older than it really is. Death occurs in a state of extreme exhaustion.

The above description applies to infantile enterocolitis, as it so frequently occurs in the cities. It is sometimes much more violent, attended by much greater febrile reaction, and is more speedily fatal. Especially is this the case when it is due to the impression of cold; such cases are not infrequent in the winter months, in the country as well as city.

Instead of the mild and gradual commencement which I have described, infantile enterocolitis may be preceded by violent symptoms—a true cholera morbus. Vomiting and purging, more or less severe, precede the inflammation. Among my records are cases which commenced from eating gooseberries, currants, cherries, and cheese; the cholera morbus produced by these indigestible substances ending in protracted inflammation.

Cholera infantum, in which the symptoms from the first are violent and alarming—a disease attended by vomiting and frequent watery stools, occasionally ends in the establishment of intestinal inflammation; and as there are no symptoms by which it is possible to determine precisely when the inflammation begins, it seems as if the inflammation itself had this violent commencement. But the severe choleraic symptoms usually abate before the inflammation is established.

ANATOMICAL CHARACTER:—Billard says: "In eighty cases of inflammation of the intestines that I examined with great care, there were thirty of *cæcro-colitis*, thirty-six of *cæcitis*, and fourteen of *colitis*." M. Legendre, in twenty-eight cases of diarrhoea, found colitis alone in nine, and in the cases in which enteritis occurred colitis was also present. Billiet and Barthes state, that in certain rare instances almost the entire digestive tube is affected; that in exceptional cases the principal lesion is found in the small intestine, while, on the other hand, the large intestine is the part of the alimentary canal which is most frequently and intensely inflamed. Billard describes four kinds of intestinal phlegmasia: first, erythematic; second, with altered secretion; third, follicular; fourth, with disorganization of tissue. In some of the best works on diseases of children, published subsequently to Billard's, different kinds of inflammation are described, according to the presence or absence of certain anatomical changes, as ulceration or softening. Practically little is gained by such a division of the general disease, and the lesions which are made the basis of the division are often merely the result of severe and protracted, simple or erythematic, inflammation. I have records of the post-mortem appearances in eighty-two cases of intestinal inflammation in the infant. Eleven of these occurred in private or dispensary practice; about fifty in the Nursery and Child's Hospital, and the remainder in the Infant Asylum of this city. In addition to these cases, I have witnessed a considerable number of post-mortem examinations of infants who died of this disease in the infant's service of Charity Hospital. The records of these autopsies were not preserved, but the lesions corresponded in general with those observed in the other institutions. The question may properly be asked, can inflammatory hyperæmia of the intestinal mucous membrane be distinguished from simple congestion if there is no ulceration and no appreciable thickening of the intestine? This is sometimes difficult, and it is possible that occasionally I have recorded as inflammation what was simple congestion, but I do not think that I have incorporated a sufficient number of such cases to vitiate, at all, the statistics. In a large proportion of cases there was manifest thickening of the intestinal mucous membrane or other unequivocal evidence of inflammation. The following is an analysis of the eighty-two cases.

The upper part of the small intestine, embracing the duodenum and jejunum, was found inflamed in twelve cases. It was free from inflammation, and of a pale color in fifty-one cases. The ileum was inflamed in forty-nine cases, and the caecal portion, including the ileo-caecal valve, was the part in which the inflammation was uniformly most intense and to which it was often confined. In sixteen cases there was no ileitis, and in thirteen no enteritis whatever. Therefore the ileum was inflamed in all but three of the cases of enteritis, in which the records give the exact location of the disease. In fourteen cases there was vascularity in streaks or in patches, or simple arborescence in some part of the small intestines, the records not stating its exact location.

In most cases the inflamed mucous membrane was perceptibly thickened. Occasionally, especially if the vascularity was slight, the thickening was scarcely appreciable. In one case there was so much thickening of the ileum, next to the ileo-caecal valve, that the mucous coat appeared as if closely studded with small warts. Ulcers of small size were found in the mucous membrane of the small intestines in five cases. These ulcers in one case were in the jejunum, in two in the ileum, and in two in both these divisions of the intestine. They were for the most part quite superficial, and circular or oval.

It is seen from the above records that the portion of the small intestine most frequently inflamed was the ileum. The inflammation usually affected the ileo-caecal valve, and extended from it to a greater or less extent along the small intestine. In general, when inflammatory patches were found in different parts of the small intestine, those in the ileum nearest the ileo-caecal valve, presented the greatest vascularity and thickening. Billard noticed in his cases the frequency and intensity of the inflammation in the terminal portion of the ileum, and the consequent thickening of the ileo-caecal valve, and conjectured that the vomiting so common and obstinate in enteritis might be due to obstruction at the ileo-caecal orifice in consequence of this thickening. I have often seen the orifice reduced to a very small size from the hyperaemia and thickening of the valve, but have not seen any accumulation above it or other evidence of obstruction.

The inflamed mucous membrane was softened in greater or less degree according to the intensity of the inflammation. Some-

times the vessels of the submucous cellular tissue were injected, and this tissue infiltrated. The softening of the mucous coat, and the firmness of its attachment to the parts underneath varied considerably in different specimens. I was able, in cases in which there was considerable softening, to detach readily the mucous coat with the nail or back of the scalpel, within so short a period after death that it was evident that the change of consistence could not have been cadaveric.

The infants in whom the duodenum and jejunum presented the inflammatory lesions, were, with few exceptions, under the age of three months, and in many of these cases there was hyperemia of the gastric mucous membrane, and in some also stomatitis.

In all the cases except one, namely, in eighty-one, there were lesions indicating inflammation of the mucous membrane of the colon. In thirty-nine, the inflammation had affected nearly or quite the entire extent of this portion of the intestine; in fourteen, it was confined to the descending portion entirely, or almost entirely; in twenty-eight cases, the records state that colitis was present, but its exact location was not mentioned. In eighteen of the examinations, the mucous membrane of the colon was found ulcerated. According to these statistics there is colitis in nearly every case of intestinal inflammation in infancy, and in a large proportion of cases, also, ileitis. The portion of the colon which is most frequently inflamed is that in and immediately above the sigmoid flexure. If the colitis affects other portions also, it is nevertheless in this part that we find the most marked inflammatory lesions.

The solitary glands, both of the large and small intestines and Peyer's patches are involved in nearly all cases of this disease. Even in non-inflammatory diarrhoea they become tumefied, so as to be distinctly visible and somewhat elevated. In enterocolitis, as we have already seen, they present different appearances, according to the degree and duration of the inflammation. In recent cases, and in parts of the intestine where the inflammatory action has been mild, there is often no perceptible change of these glands except slight enlargement with vascularity. This enlargement is most apparent if the intestine is viewed by transmitted light, when not only the glands are seen to be swollen, but their central dark points are also quite distinct. If there is

a higher grade of inflammation, or inflammation more protracted, the volume of the solitary follicles is so increased that they rise above the common level and present a papillary appearance. Peyer's patches are in a corresponding degree thickened.

The enlargement of these glands is due to hyperplasia, namely, an augmentation in the number of the elementary cells. The ulceration in the cases which I have examined appeared to be primarily and chiefly follicular. While some of the solitary glands in a specimen were found simply tumefied, others were slightly ulcerated, and others still nearly or quite destroyed. The ulcers were usually from one to three lines in diameter, circular or oval, with edges a little raised, and red. They resembled in appearance the ulcers in follicular stomatitis. In one or two instances I have seen small coagula of blood in the ulcers, and I have also seen ulcers which had evidently been larger, having partially healed. The principal seat of the ulcers was in the descending colon. They were either found in this portion of the intestine only, or, if occurring elsewhere, they were here most abundant.

Those patients in whom I have found ulcers have been ordinarily over the age of six months, which is the time when there is greatest development and activity of the glandular apparatus. In none of the cases observed by me were Peyer's patches ulcerated, though generally tumefied.

In cases in which the *cæci* coli was inflamed I have sometimes found the mucous membrane of the appendix vermiformis also injected and thickened. In one case only was there pseudomembrane upon the inflamed surface. This was in the descending colon, and it was thin like a film. The rectum presented no inflammatory or other lesions, or but slight lesions in comparison with those in the colon. Often, when there was almost general colitis, the rectum was found of a pale color, or but slightly vascular. This may explain the rare occurrence of tenesmus, in infantile enterocolitis. Upon the inflamed membrane, especially in the small intestine, there is often a layer of mucus, mixed with epithelial cells, and sometimes with blood.

The mesenteric glands are ordinarily enlarged, unless in very young infants. They are frequently found as large as a large pea, or even larger, and of a light color, from the anæmic state of the infant. In only one case did I find a tubercular deposit in the

mesenteric glands, although there was often extreme congestion. The enlargement of these glands, like that of the solitary follicles and Peyer's patches, is from hyperplasia. The condition of the stomach was recorded in sixty-nine cases. In forty-two it was healthy; in seventeen, red, apparently inflamed; in seven, of a pink color; and in three there were ulcerations, probably cadaveric. The usual healthy condition of the stomach is a noteworthy fact, taken in connection with the frequent vomiting, in enterocolitis. I have stated elsewhere that stomatitis is also a common complication in protracted and grave cases, accompanied by sponginess of the gums, which bleed if pressed or rubbed. The buccal surface in these cases is more vascular than natural, and if the vital powers are much reduced, superficial ulceration is not infrequent, especially of the gums. In infants under the age of three or four months, oesophagitis is also a common accompaniment of enterocolitis.

Thrush, though a frequent complication under the age of three or four months, is rare in older infants. Thrush, in infants over the age of eight or ten months, occurring in connection with intestinal inflammation, is an unfavorable prognostic sign, indicating a gravity of the intestinal disease, which commonly eventuates in death.

There exists an opinion in the profession that the liver is in fault in this disease, especially in that form of it which I have described as a summer epidemic of the cities. This opinion is, probably, less prevalent than formerly, but it is still held by many, and it influences, more or less, the choice of therapeutic agents. In the appendix (B) is a table, which presents the condition of the liver in thirty-two cases of this disease. These cases occurred during the summer epidemic.

There was no evidence from the post-mortem appearance of the liver in these cases, of any congestion, or torpidity, or hyperactivity, or perverted secretion. The size of the liver was in some cases very different in those of about the same age, but probably there was no greater difference than usually obtains among glandular organs within the limits of health. The following table gives the weight of the liver in twenty cases, in which the weight of this organ and the age of the patient are recorded—

Age.		Age.	
4 weeks	1	10 months	6
2 months	2	12 "	8
3 "	3	14 "	9
4 "	4	15 "	10
5 "	5	16 "	11
6 "	6	17 "	12
7 "	7	18 "	13
8 "	8	19 "	14
9 "	9	20 "	15
10 "	10	21 "	16

I do not have access to tables giving the weight of the healthy liver at different ages, but in none of the above cases did the size or the weight seem to me to be above the healthy standard, except in one, in which this organ was quite fatty. But in this case the size of the liver was probably due to the tubercular disease.

In most of the cases the liver was examined microscopically, and the only fact worthy of note observed was the variable amount of fatty matter. Sometimes it was in excess, sometimes in moderate quantity or rather deficient, and sometimes in greater amount in one portion of the organ than in another.

The prevalent belief then that the liver is greatly affected in the summer epidemic of entero-colitis, receives no corroboration from the inspection of this organ. The only pathological state (if it be such) observed in it, relates to the amount of oily matter, and this obviously requires no special treatment.

The cutaneous affections complicating entero-colitis have already been alluded to.

Frequently at post-mortem examinations of infants who have died of entero-colitis, intussusceptions are found in the small intestines. These probably in general occur at the moment of, or not long before, death, but I have in a few instances found intussusceptions which sustained the weight of two feet or more of intestine without being released, and which from being in their interior more vascular than the contiguous membrane either above or below, probably occurred some hours, possibly days, before death, but being sufficiently pervious to allow the food to pass, the symptoms of obstruction common to invagination were lacking.

It has been said, in speaking of the symptoms, that a cough is common in the advanced stages of entero-colitis, particularly

when the disease is protracted for weeks or months. From the great emaciation and the character of the cough, the physician as well as friends is very apt to suspect the presence of tubercles. In the eighty-two examinations, however, which I have made of *entero-colitis* of the summer season, in many of which emaciation was extreme, there were tubercles in only one case. The cough was found to be due to solidification of the posterior and dependent portion of one or both lungs. The exact pathological character of this solidification of lung is treated of in our remarks on diseases of the respiratory organs.

In the cases of *entero-colitis* which were complicated with this state of the lungs, I have not usually found enough of the lung tissue involved to make any perceptible difference in the sound on percussion. Its extent of solidification was sometimes not more than two or three lines, and frequently not more than a quarter to half an inch in an antero-posterior direction, although it involved nearly or quite the entire posterior surface of the lung.

The state of the brain in the *entero-colitis* of infancy is interesting to the pathologist. When the disease is protracted, this organ wastes like the body and limbs. In the young infant in whom the cranial bones are still ununited, the occipital and sometimes the frontal become depressed in proportion to the loss of brain substance, so that the cranium is quite uneven. In older children with the cranial bones consolidated, serous effusion occurs according to the degree of waste, thus preserving the size of the encephalon. The effusion is chiefly external to the brain, extending on each side over the convolutions from the base to the vertex. The quantity of serum varies from one or two drachms to an ounce, or even more. The serous effusion is associated with passive congestion of the cerebral vessels and cranial sinuses.

DIAGNOSIS.—The only disease with which infantile inflammation of the intestines is likely to be confounded, is non-inflammatory diarrhoea. The means of diagnosing the one from the other are indeed uncertain. There is no pathognomonic sign or symptom, in the majority of cases, in either affection. Occasionally we are able to diagnose colitis from the presence in the stools of mucus, or mucus tinged with blood. Abdominal tenderness, which in the adult is so important a diagnostic

symptom of intestinal inflammation, is generally absent in the infant, or, if present, is not easily ascertained. The presence of fever and the severity and persistence of the symptoms, render it probable that the disease is inflammatory.

In general I have found that if diarrhoea continued more than a week in the summer season, it had become inflammatory. Sometimes, however, as I have in at least three cases seen, and as the French physicians state, diarrhoea may continue for a much longer time, attended by extreme emaciation and terminating fatally, and yet at the post-mortem examination no lesion of the intestines be found, except a tumefied state of the intestinal glands. Practically it matters little whether we ascertain the inflammatory or non-inflammatory character of the disease as we determine the proper mode of treatment, from the symptoms and general condition of the patient.

PROGNOSIS.—I have said that intestinal inflammation is one of the most fatal of infantile diseases. Still it is possible, by proper hygienic measures and a judicious selection and use of medicines, to save a large proportion of those affected. Enterocolitis, and most of its complications are of such a nature that we may have reasonable hope that the infant will recover, if all measures calculated to control the disease are employed. Many do recover from a state of emaciation and feebleness which, occurring in any other pathological state, would be almost necessarily fatal. The most unfavorable symptoms in this disease, except those due to extreme prostration or collapse, arise from the state of the brain. Rolling the head, squinting, feeble action of the pupils, spasmodic or irregular movements of the limbs, indicate the near approach of death. There are many facts which should be taken into consideration in making a prognosis. The age of the infant, the time in the year, the surroundings, especially in reference to the impurity of the atmosphere, are to be considered, as well as the present state of the patient.

Intestinal inflammation of infancy might, in many instances, be prevented by judicious measures. Especially is it preventable in those cases in which the exciting cause is dietetic. The reader is referred to the chapters on weaning and artificial feeding, for facts in reference to this matter. Unfortunately, however, the physician is not generally consulted in regard to the alimentation of the infant, or the time and manner of weaning, or other important matters of regimen until diarrhoea, inflamma-

tory or non-inflammatory, is established; his purpose is then not to prevent, but to cure.

TREATMENT. *Regimenal Measures.*—Intestinal inflammation of infancy requires somewhat different treatment, according to the cause, as well as the condition of the patient. If it occur in an infant of previous good health, and from exposure to cold, its diet should at first be reduced. If it be nursing, it should take the breast less frequently. It will then receive less nutriment not only in consequence of the longer interval between the times of nursing, but because the milk remaining in the breast becomes more watery and less nutritious. If thirsty, it may take a little light barley-water or gum-water. If the infant be weaned, a corresponding reduction in its nutriment should be made.

These cases require mild counter-irritation over the abdomen, followed by emollient poultices, or warm water applications covered with oil silk. After the acute stage has passed, more frequent nursing, and more nutritious diet should be allowed. Often the alcoholic stimulants in barley-water, and sometimes the animal broths are required in this stage of the disease. Exhaustion should be guarded against in the infant.

As one of the chief causes of intestinal inflammation of infancy, particularly in the city, is the use of food which does not agree with the digestive system, feeble and easily deranged at that early age, attention should be directed, in those cases in which the disease does not seem to be due to the impression of cold, not only to the nature of the food, but to the mode of its preparation and the quantity given. To the young infant with enterocolitis, no food is so easily digested, and is therefore so suitable, as the human milk. The bottle-fed infant, under the age of twelve months, remaining in the city in the summer season, and affected with intestinal inflammation, cannot in general be successfully treated, unless it is provided with a wet-nurse. Frequently when the diarrhoea continues in spite of all other measures hygienic and medicinal, the infant begins at once to improve by the employment of a wet-nurse. It is sometimes really surprising to observe as a consequence of this measure the rapid and complete restoration to health from a state of extreme emaciation.

In certain cases the breast-milk, either of the mother or wet-nurse, disagrees with the infant and its use aggravates the intestinal disease. In the country or in the city in the cool months,

weaning may be proper under such circumstances. Certainly weaning, or the employment of another wet-nurse, is required. In the city in the summer months, for reasons elsewhere fully stated, weaning is a very injudicious if not fatal measure, and if the enterocolitis is aggravated by the character of the mother's milk, a wet-nurse should be engaged. If the breast milk is suspected as the cause, or one cause of the infant's sickness, it should be examined by the microscope, before a change in diet or in nursing is recommended. It has been ascertained by the microscope, that the elements of colostrum which have a purgative effect may return at any period of lactation.

If the mother's milk disagrees, and a wet-nurse for any reason is not employed, it is then necessary to recommend a diet which will be the best possible substitute for the natural aliment. For facts in reference to artificial feeding, and for dietary formulae, the reader is referred to chapters relating to this subject, and to Appendix A.

Attention to the diet of infants affected with intestinal inflammation is obviously of the utmost importance, but one chief cause of the disease, especially of the great summer epidemic of the cities, we have seen to be atmospheric. This requires attention on the part of the practitioner, to a different matter in the hygienic management of these cases; namely, the state of the air which the infant breathes. In the cool months, the atmosphere is more pure than in the summer months, as it contains less of those noxious gases which arise from decaying animal and vegetable substances. In those months, then, in which the weather is such that there is no decomposition of organic matter, the atmospheric cause of enterocolitis is not operative, and little is gained for the patient by change of locality. But in the summer season, one of the most important conditions of successful treatment of this, and the other diarrhoeal maladies of infancy, is the removal of patients from an impure to a pure atmosphere. Physicians of experience all agree in the choice of elevated localities, containing a sparse population, and remote from the sea shore. Many are the instances every summer in this city of infants removed to the country with intestinal inflammation, with features haggard and shrunken, with limbs shrivelled and skin lying in folds, too weak to raise or at least hold their heads from the pillow, vomiting nearly all the nutriment taken, with stools frequent and thin, re-

sulting in great measure from molecular disintegration of the tissues, presenting indeed an appearance seldom seen in any other disease except in the last stages of p^halitis, and returning in late autumn, with the cheerfulness, vigor, and rotundity of health. The localities usually preferred by the physicians of this city are the elevated portions of New Jersey and Eastern Pennsylvania, the Highlands of the Hudson, the central and the northern parts of New York State, and Northern New England. Taken to a salubrious locality, the infant will soon begin to improve after it has recovered from the fatigue of travelling, unless the case is inoperable.

Sometimes parents not noticing the immediate improvement which they had been led to expect, return to the city without giving the country fair trial, and the life of the infant is almost necessarily sacrificed. Returned to the foul air of the city while the weather is still warm, it sinks rapidly from an aggravation of the malady. Dr. James Jackson recommends if the infant do not improve where it is taken, that it should be conveyed to another locality. This is good advice, provided the selection be made of a place elevated, remote from the sea shore, and having a sparse population. The infant, although it has recovered, should not be brought back while the weather is still warm. One attack of the disease does not diminish but increases the liability to a second seizure.

If the situation of the family is such that it is not practicable to take the infant to the country, and such cases are frequent among the poor, it should be kept much of the time in the open air; it is a common practice in this city to take such patients in the daytime to the sea shore, or upon ferry boats. Dr. E. H. Parker says: "Many of my patients are sent to the ferries to cross them, so that the cool fresh sea breeze may fan them, and it acts sometimes like magic, to raise their drooping heads." I have not observed such marked benefit in these cases from the sea breeze as from the air of elevated localities, which can generally be found in the vicinity of cities, and are easily accessible.¹

Medical Treatment.—Sometimes it is proper to commence treatment by the employment of a gentle purgative, particularly when the disease commences abruptly, from a state of previous

¹ The remarks made in reference to the use of pepsin in indigestion and non-inflammatory diarrhoea apply also to those cases of inflammatory diarrhoea which are due to feebleness of the digestive function.

good health. It is then frequently caused by exposure to cold, or more rarely by some indigestible and highly irritating substance in the intestines. In such patients, there is often a full habit. The pulse is strong and quick, the heat of surface great; the face perhaps flushed, the stools sometimes slimy and bloody, sometimes green or brown. It is proper and often serviceable when there is this commencement of the affection, to give a single dose of castor oil or syrup of rhubarb. Any indigestible substance, if present, is removed from the intestine, and opiates or other remedies designed to control the disease may then be more successfully employed. Such cases occur in the winter not less than in the summer, and in all localities, rural as well as in the city. But the summer epidemics of intestinal inflammation in the cities do not in general require such preliminary treatment. Diarrhoea, moderate, perhaps, has already continued for a time when the physician is called, and no irritating substance remains except the acid, which is abundantly generated in the intestine in this disease, and which we have a means of removing without purgation. Preliminary treatment having been employed or not, according to the nature of the attack and condition of the patient, remedies calculated to arrest the inflammation should then be prescribed.

The medicines which should be employed are chiefly of three kinds, namely, alkalies, opiates, and astringents. Sometimes one or two kinds only, and sometimes all three, according to the character of the evacuations. The antacid treatment is, of course, required in those numerous cases in which the stools are acid, and there is no better alkaline remedy for the diarrhoea in this disease than the preparations of chalk. The creta preparata of the pharmacopoeia, in doses of two or three grains to a child one year old, or the mistura cretae in teaspoonful doses, are eligible preparations, and are commonly employed. These medicines should be repeated in two hours, or a longer time, according to the state of the patient. Chalk given for a moderate period, is innocuous, and may be administered to the youngest child.

In Europe, the crab's eye is much used, and it is stated that it is sometimes effectual in controlling the disease, when the chalk fails. The following is a formula recommended by Bouchat:—

R.—Ocul. cancer. pulv. gr. x;
Aq. Cretæ℥.
Syr. stat. ad ʒss.—℥.

One teaspoonful every hour. In this country the same method has been also employed, though less frequently than the preparations of chalk. J. F. Meigs, of Philadelphia, prescribes it as follows:—

R.—Ocul. cancer. pulv. ʒi;
 Acacia pulv. ʒi;
 Sacch. alb. ʒi;
 Aq. Surtia,
 Aq. cinnamom. aa ℥ss.—M.

A teaspoonful four, five, or six times daily. By means of this alkali alone, aided by proper hygienic measures, the disease is sometimes arrested, but unless circumstances are favorable, and the case is mild, other medicines are required.

Opium is used by most practitioners in the treatment of intestinal inflammations of infancy. Either as a main remedy or adjuvant it is employed, and properly, in nearly all severe cases. For a young infant paregoric is an eligible preparation of opium. For the age of one month, the dose is three to five drops; for the age of six months, ten to twelve drops, repeated in three hours or a longer time, according to the state of the patient. After the age of six months, the stronger preparations of opium are more frequently used. At the age of one year, the liq. opi. composita, or tincture opii may be given in doses of one to two drops. Dorer's powder is also an excellent medicine in this disease, given in doses of three-fourths of a grain to an infant six years old.

Opium is, however, in general best given in mixtures which will be mentioned hereafter. It quiets the action of the bowels, and diminishes the number of evacuations. It is contraindicated or should be used with caution if cerebral symptoms are present. Sometimes in the commencement of the disease, if there is much febrile reaction, the patient may be drowsy and in danger of convulsions. Then opiates should be omitted or given cautiously. Also in the advanced stages of this disease, when, perhaps, there is more or less serous effusion in the cranial cavity, opium should be cautiously used, as it might tend to produce that fatal stupor, in which the unfavorable cases are apt to terminate.

Astringents are required when the evacuations are thin and frequent, and are not sufficiently controlled by the remedies already

mentioned. Those of a vegetable nature are usually preferable, as they are compatible with chalk, and may be given in combination with it. The astringents commonly used are, catechu, kino, krameria, tannic and gallic acids. Logwood and blackberry roots are also occasionally employed.

If the disease become chronic, nitrate of silver and acetate of lead are sometimes useful. Astringents should not be given if the stools are scanty and consistent, though frequent, nor should they be employed if the evacuations are mucus-sanguinolent, as in the dysentery of the adult.

I will now mention the various combinations of medicines which have been found the most useful in intestinal inflammation.

In all those cases in which the evacuations consist chiefly of mucus, or mucus and blood, and in all recent cases in which the evacuations are scanty, and there is considerable fever, one of the best formulæ is the following, which is similar to that recommended by Dr. West:—

R.—Tinct. opii gr. xij;
 Pulv. gum. arab.,
 Pulv. starch, ʒss. ss ʒj;
 Ol. stœc. ʒj to ʒij;
 Aq. cinnamon. ʒjss.—M.

One teaspoonful from three to six hours. In these cases, also, Dover's powder, given at the same interval with half a teaspoonful of castor oil, once or twice daily, will have an excellent effect in controlling the disease.

Dr. E. H. Parker (*American Med. Monthly*, May, 1857) says of the treatment of this disease: "When the colitis is more severe and prominent, and when the condition approaches that of dysentery, for several years I have, in this state of affairs, used with much satisfaction a mixture of about ten grains of blue mass rubbed up in two drachms of syrup of rhubarb, to which is added one-half teaspoonful of paregoric and four ounces of chalk mixture. Of this a teaspoonful every two or three hours is the dose. The blue mass certainly does not act like the calomel, not producing in purgative doses so great prostration, and in small doses it does not lessen the proportion of fibrin in the blood, as is the case with calomel." I have never used this mixture, having been generally satisfied with the effects of the castor oil mixture.

In the more common forms of infantile enterocolitis, in which

the stools are green, or brown, or yellow, and are watery and frequent, one of the best medicines is the pulv. cret. comp. & opoi. combining, as it does, alkali, opiate, and astringent.

Three grains may be given every two or three hours to a child one year old, till the diarrhoea is controlled. For young infants paregoric, catechu, and chalk, recommended in the treatment of non-inflammatory diarrhoea, is a useful mixture. Laudanum or liq. opoi. compo. in proper quantity may be substituted in place of the paregoric, and kino or krameria in place of the catechu.

Gallic or tannic acid is sometimes administered with Dover's powder, or with the compound powder of chalk and opium, but given in this way it is nauseating and apt to be vomited. If the evacuations are not frequent or watery, the opiate and chalk mixture may be prescribed without the astringent with a good effect.

In some instances a simple astringent is required. The syrup of rhubarb is one of the best remedies of this kind. It is not unpleasant to the taste, and is effectual. A tea of blackberry-root, or blackberry root and cinnamon, is occasionally used: generally, however, as an adjunct to other medicines. I have sometimes prescribed this, but have not ordinarily found it sufficiently astringent given alone to diminish materially the number of evacuations. I do not know that any benefit is gained in intestinal inflammation of the infant by the use of mercurials, and in many cases certainly much harm would result. They are not now commonly prescribed in the enteritis or colitis of adults, and there is no lesion in infantile entero-colitis, either as regards the liver or intestines, which requires their administration. In the choleric form diarrhoea, which sometimes precedes intestinal inflammation, the use for a day or two of small doses of calomel or hydrarg. cum cret. is thought by some judicious practitioners to be of service, but when it has appeared to be beneficial in intestinal inflammation, the good effect is probably due chiefly to the opium, which is administered with the mercurial.

Often the disease continues, notwithstanding the use of the above remedies, or if temporarily relieved, the causes still operating, it returns. In these protracted cases, attended perhaps with more or less ulceration of the mucous membrane, the mineral astringents may be prescribed. Acetate of lead may be given in doses of one-fourth of a grain to an infant one year old. Nitrate

of silver is, however, more frequently prescribed in Europe, especially on the continent. It may be given in doses of one-twentieth to one-twelfth of a grain in a little mucilage or simple syrup.

Enemata.—These are of great service in many cases of intestinal inflammation. At any stage of the disease, when the stomach is irritated and medicines are not retained, they may be advantageously employed. Laudanum, especially, is often given in this way to the infant with great benefit. It may be prescribed mixed with a little starch water, and the best instrument for administering it is a small glass or gutta-percha syringe, the anus retaining the enema for a time by means of a compress. Beck, in his *Infant Therapeutics*, advises to give by injection twice as much of the opiate as would be administered by the mouth. A somewhat larger proportion may, however, be safely employed. Astringents may also be given by enema. Bouchut, speaking of these therapeutic agents, says: "All these substances may be given as enemata, composed of three to six ounces of the vehicle holding in solution seven to ten grains of the extract of rhatany or monesia. If tannin is used, it should be in the dose of four to seven grains. In the same way and for the same end fifteen to thirty grains of alum, or, better still, less than one grain of the nitrate of silver. These last enemata are daily employed at the Necker Hospital. If their use is not constantly followed by success, there always results, at least, a decided amelioration quite capable of dissipating the objections raised against their employment."

In most of these cases of intestinal inflammation which occur under the depressing effect of warm weather alcoholic stimulants are required almost from the commencement of the disease, and their use is beneficial in chronic or protracted cases, whatever the cause or season. Bourbon whisky or brandy is the best of these stimulants; and it should be given in small doses, repeated at intervals of two hours. I have usually ordered three or four drops to an infant one month old, and an additional drop or two drops for each month. The stimulant is not only useful in sustaining the vital powers, but it also aids in relieving the irritability of stomach.

The diarrhoea is, in general, more easily controlled than the

vomiting. The remedy which with me has been the most successful in relieving the latter symptom is the neutral mixture:—

R.—Potas. bicarbonate gr. xvj;
 Acid. citric. gr. xvij;
 Aq. amygdal. amaræ ℥j;
 Aque ℥ij
 Mies.

Dose, one teaspoonful to a child from eight to twelve months old, repeated according to the nausea or vomiting. The following prescription has been employed in the Nursery and Child's Hospital of this city to relieve this symptom, and it has the desired effect in a certain proportion of cases:—

R.—Creasot. gr. ij;
 Aq. caldæ ℥ij.
 Mies.

Dose, one teaspoonful with a teaspoonful of milk, breast milk if the infant nurses, repeated according to the symptom. Lime-water alone sometimes diminishes the vomiting when there is great acidity, but it is rendered more effectual by the addition of creasote. Vomiting is frequent in the summer epidemics of intestinal inflammation in the cities, and it is in this form of the disease, induced by an impure atmosphere and an unsuitable diet, that I have observed the greatest benefit from the above prescriptions. When the inflammation occurs in other seasons, and is produced by other causes, vomiting is less frequent, and is more easily controlled. It may then require no special treatment.

Another anti-emetic employed in these cases, though, according to my experience, inferior to those already mentioned, is the sub-nitrate of bismuth:—

R.—Bismuth. subn. ℞j-℞j;
 Aq. menth. pipert.,
 Syt. singl., ss ℥j.
 Mies.

Dose, one teaspoonful to a child one year old, every hour if required for the vomiting. The bismuth, aside from its relative effect upon the stomach, also aids in controlling the diarrhoea. On the continent it is employed for the latter purpose.

In cases attended by great irritability of stomach, nutriment should be given in small quantity. The infant will often, in consequence of thirst, nurse or take drinks more frequently than it

requires for alimentation, and the stomach is overburdened and rendered more irritable in consequence. By proper care in reference to the diet, the vomiting sometimes subsides of itself.

EXTERNAL TREATMENT.—Some writers recommend depletion in this disease by leeches, advice likely to do much harm, unless the particular cases are described in which it may possibly be of service. It can be useful only in those cases in which the infant is robust and of full habit, and the disease commences suddenly with decided febrile reaction. Such cases are oftenest seen with us in the winter season, and even these are ordinarily best treated without loss of blood. Sinapisms and poultices mostly are sufficient as local measures. In these cases, also, the warm mustard foot-bath should be employed, and repeated if there is restlessness or cerebral symptoms.

In all forms of intestinal inflammation in infancy and in all its stages, mild counter-irritation over the abdomen may be useful, but vesication, by increasing the restlessness of the infant and reducing its strength, without materially modifying the severity or duration of the disease, does more harm than good. It is not to be thought of as a remedial measure. I have known a troublesome sore continuing till death, and probably hastening this result, to occur from this treatment. Poultices or fomentations over the abdomen are sometimes useful, especially those of a mildly irritating nature. A poultice of powdered cloves, cinnamon, and ginger, or of linseed meal to which a little mustard is added, may be employed, or, better than either, a linseed poultice spread thin, under which a single layer of muslin is placed, saturated with tincture of camphor, and over both oil silk. In the entero-colitis of infants occurring in the cool months, and due to exposure to cold, this treatment is especially useful. In the epidemic entero-colitis of the summer months, which may be aggravated by heat, treatment by poultices may be injudicious, but in such cases it is proper to produce moderate redness over the abdomen by temporary applications.

Some physicians believe that dentition is a cause of infantile entero-colitis, and advocate having the gums if they are foetid swollen. In my opinion, this treatment, in genuine inflammation, is opposed by both reason and experience.

CHAPTER IX.

ENTERITIS AND COLITIS IN CHILDHOOD.

INTESTINAL inflammation in childhood differs materially from the form or type which it commonly presents in infancy. Its causes, symptoms, and extent differ in important particulars in the two periods. In childhood there is not ordinarily such extensive inflammation of the mucous membrane of the intestines as we have seen is present in the majority of cases in infancy, and it may, therefore, be properly treated as two diseases, according to the seat of the morbid process, namely, enteritis and colitis. Both these affections in the child resemble so closely the form which they exhibit in adult life, that no extended description is needed in this connection.

CAUSES.—These are vicissitudes of temperature, especially sudden change from warm to cold, which checks the perspiration, and causes a determination of blood from the surface to the viscera. These inflammations are also caused sometimes by irritating substances in the intestines. I have known fecal accumulations as well as worms to produce severe dysentery in the child, accompanied by the characteristic tenesmus and mucosanguineous stools, and ceasing as soon as the offending substances were expelled. The use of unripe or stale vegetables, if there is a strong predisposition to mucous inflammation, may be a sufficient cause, and some of the most dangerous cases are due to the accumulation in the intestines of seeds and the pericarpium of fruits. But the most common cause is that mentioned, namely, sudden exposure to cold when the body is heated, a danger to which children are especially liable, on account of the easy disturbance of the circulatory system in them, and their heedless exposure of themselves, unless incessantly watched.

Enteritis and colitis are also frequently secondary diseases. They occur in children as complications or sequelæ of the eruptive fevers, especially measles.

SYMPTOMS.—The alvine discharges in enteritis and colitis in childhood are such as occur in these diseases at a more advanced age. In enteritis they are thin and of the natural color, or occasionally green; in colitis they are more consistent than in enteritis, and are largely mucous-sanguineous. Sometimes in enteritis, if the inflammation is not intense, the diarrhoea is slow in appearing, or it may be slight, so as not to attract special attention. The disease may then resemble remittent fever, for which it is sometimes at first mistaken. The upper part of the small intestines is less frequently affected than the lower. If there is duodenitis, the flow of bile is sometimes impeded from tumefaction at the mouth of the common bile-duct, and the icteric hue appears. In both enteritis and colitis there is abdominal tenderness, with more or less constant pain if the disease is severe, and in colitis, tormina and tenesmus. The pulse is accelerated, the heat of surface augmented, the face flushed, and, except in mild cases, indicative of suffering. In many children at the commencement of the inflammation the nervous system is profoundly affected, as indicated by headache, stupor, twitching of the limbs, and sometimes by convulsions. The chief danger at the commencement of the disease is, indeed, from this source. Sometimes there is irritability of the stomach, and the food is rejected, though much less frequently than in the intestinal inflammation of infancy. Anorexia and thirst are common symptoms. If the inflammation continues, there is soon perceptible emaciation, with loss of strength. The eyes become hollow, the face pale, and the surface cool. Death may occur at an early period, the vital powers succumbing from the intensity of the inflammation. In other cases, the acute disease ends in a subacute or chronic inflammation; the patient becomes gradually more reduced, till he dies in a state of extreme emaciation, such as we often observe in the entero-colitis of infancy, or from this state he may recover by degrees, though perhaps with an irritable state of the bowels, which continues for months. In a majority of cases, however, enteritis and colitis in childhood, if not neglected, soon begin to yield, and terminate favorably, in one or two weeks.

DIAGNOSIS.—It is not difficult to determine the existence of the inflammation. This is indicated by the fever, abdominal tenderness, and the relaxed state of the bowels. Whether the disease is enteritis or colitis is determined by the character of the stools, the seat of the tenderness, and the presence or absence of tenesmus.

PROGNOSIS.—It has been stated above that enteritis and colitis in children commonly terminate favorably. The result depends not only on the extent and severity of the inflammation, but the constitution and previous health. The inflammation is more serious when secondary than when primary. Extensive and great tenderness of the abdomen, features pale, anxious, and indicative of suffering, pulse frequent and feeble, should excite the most serious apprehensions. Frequent vomiting also denotes a grave form of the disease. Stupor, and especially convulsive movements, show that the nervous centres are affected, and should make us guarded in the prognosis. Improvement in the disease, on which to base a favorable prognosis, is apparent in the diminution of the tenderness, improvement in the pulse and character of the stools, a more cheerful countenance, and less discolored food.

TREATMENT.—This should be similar to that employed in the adult. In enteritis at the commencement of the disease, if there is reason to suspect the presence of any irritating substance in the intestines, and ordinarily in colitis it is advisable to commence treatment by the use of some simple evacuant, like castor oil. After this our reliance, so far as internal treatment is concerned, must be mainly on opiates, or opiates with diaphoretics. One of the best remedies of this class is the Dover's powder, which may be given to a child five years old, in doses of three grains every three hours. A corresponding dose of any of the other opiates may be given, but with less sudorific effect. In colitis the occasional administration of a laxative should not be neglected, if the stools are entirely or mainly mucus-sanguinous. It should be employed so as to prevent accumulation of fecal matters in the colon, which would serve as an irritant and increase the inflammation. The dose should be small, merely sufficient to produce a local evacuation, and repeated as required, daily or less frequently. The laxative commonly preferred is Rochelle salts or castor oil. The physician may prescribe an opiate mixture containing sufficient of the laxative to have the effect desired, though ordinarily it is better to prescribe the two separately, so that the laxative can be given or withheld, according to circumstances, while the opiate is continued more regularly.

When the stage of active inflammation has passed, if there is still looseness of the bowels, astringents should be employed in connection with the opiate. The tincture of catechu or kino

may be given, with an equal quantity of paregoric. Gallie or tannic acid in combination with laudanum or *liq. opii compos.* will also be found useful.

Acetate of lead in combination with opium, so much used in adult cases, is equally serviceable in children. One grain may be given to a child of five years with one-third of a grain of opium. Injections properly administered aid in controlling the inflammation. Those containing opium are especially serviceable in relieving the tenesmus of dysentery. When the stomach is irritable, or when it is desired to use a medicine like tannic acid, which is unpleasant to the taste, it is often best to administer it in the form of enemata or suppositories.

Local treatment is highly important in the enteritis and colitis of childhood. Leeches in the commencement of the inflammation have a good effect in moderating its intensity. If the disease is secondary, or there is scrofula or a state of feebleness, depletion is contra-indicated.

Apart from leeching, the local treatment should consist in the use of sinapisms, followed by emollient applications to the abdomen. The mustard should be applied three or four times daily, sufficiently to produce redness, and then followed by a poultice of linseed, or, which is a better application, some warm lotion, covered snugly with oil-silk. Tincture of camphor will frequently produce sufficient irritation without the use of mustard.

If there are symptoms threatening convulsions, a mustard foot-bath repeated occasionally will usually tranquillize the nervous system and avert the danger.

The diet should be bland and unirritating. In the first stages of the inflammation, rice or barley water, or arrowroot boiled in water and similar drinks should constitute the main diet. When the active inflammation has abated, and at any period of the disease, if there is a tendency to prostration, more nourishing food should be given. Milk and animal broths may then be allowed. In cases which are protracted, or attended with symptoms of exhaustion, alcoholic stimulants are required.

CHAPTER X.

CHOLERA INFANTUM.

CHOLERA infantum, or, as it is sometimes called, cholera infantum diarrhoea, is a disease of the summer months; and, with exceptional cases, of the cities. It receives the name, which designates it, from the violence of its symptoms, which closely resemble those in Asiatic cholera. It is, however, quite distinct in its nature, occurring independently of the epidemics of that disease. Post-mortem examinations establish the fact that it is a non-inflammatory diarrhoea, but on account of the violence and striking character of its symptoms, and its great mortality, it is proper to describe it as a distinct disease.

I have elsewhere stated that as regards at least this city, the term cholera infantum has been so extended as to embrace a large part of the diarrhoeal maladies affecting infants in the summer months. Some physicians apply it even to mild but protracted cases of ordinary non-inflammatory or inflammatory diarrhoea occurring in the season mentioned. I employ it, and it should, in my opinion, only be employed to designate that form of infantile diarrhoea in which there are frequent watery, perhaps serous stools, accompanied by vomiting and rapid and great emaciation. Moreover, when the disease ceases to be of this character, the term cholera infantum should no longer be applied to it, but it should receive another name indicative of the pathological state which has supervened. Intestinal inflammation frequently succeeds cholera infantum, and some writers describe it as a stage of that disease. Properly, the inflammation should be regarded as a distinct affection, just as the enteritis, which sometimes results from cholera morbus, is not considered as a stage of that disease, but as a disease in itself.

The number of deaths from cholera infantum reported in our bills of mortality is so large, while the number from the same disease embraced in the death statistics of European cities is so

small comparatively, that some have been led to believe that this affection, whether termed *cholera infantum*, or, as by French writers, *choleraform diarrhoea*, is much more prevalent and fatal in this country than in Europe, whereas, were these terms employed in all places to designate precisely the same disease, probably no great difference would be found in the prevalence of *cholera infantum* in this country and in Europe.

CAUSES.—It has been stated that *cholera infantum* prevails mainly in the cities and in the summer months. Cases occur from the month of May to October. Its maximum frequency and severity correspond with the degree of heat, and it is therefore most prevalent in the months of July and August. One of the chief causes of this disease is, doubtless, residence in an atmosphere loaded with noxious vapors, especially gases arising from animal and vegetable decomposition, or an atmosphere rendered impure by overcrowding and by personal and domestic uncleanliness. It is, therefore, much more common in tenement-houses and parts of the city occupied by the poor than in clean and less crowded streets and apartments.

Summer heat and the anti-hygienic conditions to which it gives rise in the cities, sometimes appear to be sufficient in themselves to develop *cholera infantum*; at least it occurs without other obvious cause. In other, and probably the majority of cases, another cause co-operates, namely, the use of improper food. Atmospheric heat and its depressing influences are then predisposing causes, while the use of indigestible or irritating food is the exciting cause. Infants upon whom both causes are operative, are most liable to *cholera infantum* in its severe form. Hence bottle-fed infants of the city are especially liable to it, and infants whose food is carelessly and improperly prepared. Often in the hot months, acid and indigestible fruits, as currants, heedlessly given to an infant, occasion the attack.

Cholera infantum occurs usually under the age of two years. It is so frequent during the period of first dentition, that some writers consider dentition a cause. At this period, however, as has been stated elsewhere, there is great functional activity, and rapid development of the intestinal follicles, and the peculiar liability to *cholera infantum* at this age should be attributed to this cause rather than to dentition.

SYMPTOMS.—*Cholera infantum* may be preceded by a premonitory

tory stage, that of simple diarrhoea. The stools are thinner than natural, and somewhat more frequent, but not such as to excite alarm.

Suddenly the evacuations become more frequent and watery, and the parents are surprised and frightened by the rapid sinking and real danger of the infant. Occasionally this antecedent diarrhoea has continued several weeks, attended with emaciation, and associated, perhaps, with intestinal inflammation. In other instances the previous health has been good, and cholera infantum commences abruptly.

This disease is characterized by the discharge from the bowels of thin stools, designated by some watery, by other serous. The first evacuations, unless there has been previous diarrhoea, contain considerable fecal matter. They are so thin as to soak into the diaper almost like urine, and in some cases they scarcely produce more of a stain than does this secretion. The odor is peculiar, not fecal, but muddy and offensive; occasionally the stools are almost odorless. Commencing simultaneously with the watery evacuations, or soon after, is another symptom, namely, irritability of the stomach, which increases greatly the prostration and danger. Whatever is swallowed by the infant is rejected immediately, or after a few minutes, or there may be retching without vomiting. The appetite is lost, and the thirst is intense. Cold water, especially, is taken with avidity, and if the infant nurses, it eagerly seizes the breast, evidently to relieve the thirst. The tongue is moist at first, and clean or covered with a light fur. The pulse is accelerated, while the respiration is either natural or somewhat increased in frequency; the surface is warm, but its temperature is speedily reduced. There is no abdominal tenderness, and no evidence of pain. The infant is often restless at first, but its restlessness is due to thirst, or that unpleasant sensation which the sick experience when the vital powers are rapidly reduced. The urine is scanty in proportion to the gravity of the attack.

The loss of strength, and the emaciation are more rapid than in any other diarrhoeal malady, except Asiatic cholera, and the most severe form of cholera morbus. The parents scarcely recognize in the changed and melancholy aspect of the infant any resemblance to the features which it exhibited a day or two before. The eyes are sunken, the eyelids and lips are permanently

open from the loss of muscular tonicity, and the loss of the fluids and of the flesh is such that the bony angles become more prominent, and the skin in places lies in folds.

As the disease approaches a fatal termination, which often occurs in two or three days, the infant remains quiet, not disturbed even by the flies which alight upon its face. The limbs and cheeks become cool; the eyes bleared and pupils contracted. A state of stupor results from which there is no relief, and which after a few hours ends in death.

Often, even in cases which are ultimately fatal, there is not such a speedy termination of the disease. The choleric diarrhoea ends in inflammation, which runs a protracted and obstinate course. The disease then becomes the catarrho-colitis, inflammatory diarrhoea, or intestinal inflammation of writers.

In the most favorable cases of cholera infantum the patient recovers before the supervention of inflammation.

ANATOMICAL CHARACTERS.—Billiet and Barthez, who of foreign writers treat of this disease at greatest length, describe it under the name of gastro-intestinal choleric catarrh. "The perusal," they remark, "of the anatomico-pathological description, and especially the study of the facts, show that the gastro-intestinal tube in subjects who succumb to this disease may be in four different states: (a), either the stomach is softened without any lesion of the digestive tube; (b), or the stomach is softened at the same time that the mucous membrane of the intestine, and especially its follicular apparatus is diseased; (c), or the stomach is healthy whilst the follicular apparatus, or the mucous membrane, is diseased; (d), or, finally, the gastro-intestinal tube is not the seat of any lesion appreciable to our senses in the present state of our knowledge, or it presents lesions so insignificant that they are not sufficient to explain the gravity of the symptoms.

"So far the disease resembles all the catarrhs, but what is special is the abundance of the serous secretion, and the disturbance of the great sympathetic nerve.

"The serous secretion which appears to be produced by a perspiration (analogous to that of the respiratory passages and of the skin) rather than by a follicular secretion, shows, perhaps, that the elimination of substances is effected by other organs than the follicles; perhaps, also, we ought to see a proof that the materials to eliminate are not the same as in simple catarrh. Upon all

these points we are constrained to remain in doubt. We content ourselves with pointing out the fact."

American writers very generally divide cholera infantum into three stages, the first characterized by turgescence of the intestinal follicles without inflammation, but perhaps attended by more or less softening of the mucous membrane. In the second stage intestinal inflammation is present. The mucous membrane of the intestines is vascular in patches and streaks, sometimes thickened, and the solitary glands and patches of Peyer are inflamed, and occasionally some of them are ulcerated. In the third stage the brain is involved. The cranial sinuses, veins, and capillaries of the brain are congested, and there is serous effusion upon the surface of the brain or in the ventricles. But the second and third stages of these writers pertain, in my opinion, as I have already said, to enterocolitis, a supervening disease, and distinct from cholera infantum. The anatomical character of the first stage alone is that of cholera infantum, as the disease is understood by us. In our restricted use of the term, the appreciable lesions in cholera infantum are seen to be similar to those in the common forms of non-inflammatory diarrhoea. The following observations show the character of these lesions:—

On the first of August, 1861, I made an autopsy of an infant sixteen months old, who died of cholera infantum, with a sickness of less than one day. The examination was made thirty hours after death. Nothing unusual was observed in the brain, except, perhaps, a little more than the ordinary injection of vessels at the vertex; no disease of stomach and intestines except enlargement of the patches of Peyer as well as the solitary glands; mucous membrane pale. In this and the following cases there was apparently slight softening of the intestinal mucous membrane; but whether it was pathological or cadaveric is uncertain, as the weather was very warm. The liver seemed healthy. Examined by the microscope, it was found to contain about the normal amount of oil globules.

The second case was that of an infant seven months old, wet-nursed, who died July 26th, 1862, after a sickness also of about one day. He was previously emaciated, but without any definite ailment. The post-mortem examination was made on the 28th. The brain was somewhat softer than natural, but was otherwise healthy. There was no unusual vascularity of the membranes

of the brain, and no serous effusion within the cranium. The mucous membrane of the intestines was of healthy appearance throughout, except that the solitary glands of the colon were enlarged. The patches of Peyer were not distinct.

At the New York Protestant Episcopal Orphan Asylum, an infant twenty months old, previously healthy, was seized with cholera infantum on the 25th of June, 1844. The dejections, as is usual in that disease, were frequent and watery, and attended by obstinate vomiting. Death occurred in slight spasms, in thirty-six hours. The exciting cause was apparently the use of a few currants, which were eaten in a cake the day before, some of which fruit was contained in the first evacuations. The brain was not examined. The only pathological changes which were observed in the stomach and intestines, were slight vascular patches in the small intestines, scarcely sufficient to be considered inflammatory or even congestive, and an unusual prominence of the solitary glands in the colon. These glands resembled small beads imbedded in the mucous membrane. The lungs in the above cases were healthy, excepting hypostatic congestion.

It is seen that the lesions in the above cases were not inflammatory. The observations of others correspond with our own in reference to these severe and suddenly fatal cases.

Dr. Hallowell, in a paper on this disease published in the *American Journal of the Medical Sciences*, July, 1847, says of the anatomical characters of the first stage: "These consist in an undue development of the follicles, both of the stomach and intestines, or of one of those organs, without inflammation of the mucous membrane."

Dr. E. H. Parker, in a paper read before the New York State Medical Society, February 4th, 1857, says: "When death occurs from the exhaustion produced by the profuse vomiting and diarrhoea, a condition to which is given in this country the name of cholera infantum, we find the intestines to contain more or less of a soft usually light yellow fecal matter, and the stomach a fluid resembling a thin gruel. The walls of the stomach are natural, unless the epithelial lining be a little too easily removed, the epithelial lining of the small intestines and sometimes of the large being in a similar state. The walls of the intestines are almost translucent, bloodless, and apparently thin. Throughout their whole extent the solitary

and nucleomammary glands are very prominent, setting up almost like beads upon the surface."

Both these writers, as well as Stewart in his monograph on cholera infantum, admit the frequent termination of the pathological state just described; in other words, of cholera infantum, according to our understanding of the term, in enterocolitis.

With the exception of the organs of digestion, no uniform lesion is observed in any of the viscera, unless such as is due to change in the quantity and fluidity of the blood, and in the circulation. Writers describe an anæmic appearance of the thoracic and abdominal viscera, and occasional passive congestion of the cerebral vessels. The cerebral symptoms often present towards the close of life in unfavorable cases of cholera infantum, may arise from a state of the brain similar to, if not identical with, spurious hydrocephalus, which state is not attended by any uniform or certain lesion of this organ. As the urinary secretion is scanty or suppressed, cerebral symptoms may in certain cases be due to uræmia. I believe that the opinion of writers is correct, that there is usually in cholera infantum softening of the gastrointestinal mucous membrane, at least in places. But as the autopsies in this disease are made in the warmest weather, and after the lapse of several hours, it is difficult to decide how much of this change pertains to this disease and how much is post-mortem.

DIAGNOSIS.—This disease is diagnosed by the symptoms, and especially by the frequency and the character of the stools. The stools have already been described as frequent, often passed with considerable force, deficient in fecal matter and thin, so as to soak into the diaper almost like urine. The vomiting, thirst, rapid sinking and emaciation, serve to distinguish cholera infantum from other diarrhoeal affections.

When Asiatic cholera is prevalent, the differential diagnosis of the two diseases is difficult if not impossible.

PROGNOSIS.—This is one of those diseases in regard to which physicians often injure their reputation by not giving sufficient notice of the danger, or even by expressing a favorable opinion, when the case soon after ends fatally. A favorable prognosis should seldom be expressed without qualification. If the urgent symptoms are relieved, still there is danger of the occurrence of intestinal inflammation, which, in hot weather, is formidable and often fatal. If the stools become more consistent and less frequent,

without the occurrence of cerebral symptoms, we may confidently express the opinion that there is no present danger.

The duration of true cholera infantum is short. It either ends fatally, or it begins soon to abate and ceases, or it is transformed into an inflammation. Death may occur, in twenty-four or forty-eight hours, in a state of collapse, from the frequency of the stools, or not till after three or four days. In general, if the patient is not relieved in three or four days, entero-colitis commences.

TREATMENT.—The frequency and watery character of the stools in cholera infantum, and the consequent rapid sinking of the infant, call for prompt measures for the arrest of the disease. If there is any irritating substance in the stomach or intestines, which acts as an exciting cause of the vomiting or diarrhoea, or at least aggravates it, it is proper to commence treatment by the use of some evacuant. Dr. James Jackson (*Letters to a Young Physician*) says: "In the acute attacks of cholera infantum, the first object is the dislodgement of offending materials from the alimentary canal. In most cases, the spontaneous efforts suffice to clear the stomach. But, occasionally, it is evident that these efforts fail to remove a load which the patient has imprudently been permitted to take into the stomach. Then small doses of ipecacuanha may be given with benefit till the burden is thrown off. Two to four grains will usually suffice. Much more frequently the efforts of the bowels are not successful in carrying off their contents, and the stomach is at the same time so irritable as not easily to retain medicine. Then calomel is the great remedy. Whatever objections theoretical men may make to the use of so potent a drug for a tender infant, few practical men, after having tried it, are willing to treat this disease without this article. It is not offensive to the taste; it can be retained when scarce any other medicine can be; and, if vomiting follows a dose of it, the stomach becomes less irritable, so that a way is open for other medicines or for nourishment. By its operation the bowels are disburdened of their load with benefit. But it is a medicine which is slow in its operation, and castor oil may be used after it with advantage."

Unless the stomach is quite irritable, castor oil, syrup of rhubarb, or, if there is a state of acidity, rhubarb and magnesia are generally sufficient to remove the indigestible substance. Dr. E. H. Parker prefers the syrup of rhubarb in such cases. If the

stomach is irritable, so that the purgatives mentioned would be vomited, calomel is certainly the best medicine. This should not be given to the extent of more than one or two doses, and it may be aided by a simple enema.

If there is no indigestible substance in the intestines, purgatives should not be used, as they would then do more harm than good. If the disease has continued several hours, it is probable that any irritating substance, which might have been present at first, has passed from the bowels, and no purgative is required.

Treatment designed to diminish the frequency of the evacuations and improve their character, should be commenced at the earliest moment.

Every hour that cholera infantum continues unchecked, reduces the strength of the infant and diminishes his chance of recovery. Our main reliance must be on opium in some form. Dr Jackson truly remarks that we have no substitute for it. "From three to five drops of the tincture of opium," says he, "may be given, and the dose may be repeated in eight or twelve hours." This he recommends "after the bowels are unburdened."

It is better, I think, to give a smaller dose of opium and repeat it often. If laudanum is used, it may be given in one drop doses every two or three hours to a child one year old, its effect being watched. There is danger in this disease of the sudden supervention of stupor, amounting even to coma and ending fatally. In these cases the stools are generally suddenly checked, and the opium may in a great measure be instrumental in producing this result. In instances which I can recall to mind, where death occurred in this way, the friends believed that the melancholy result was due more to the medicine than the disease. If the evacuations are partially checked and there are signs of stupor, the opiate should either be omitted or given less frequently. Explicit and positive directions to this effect should be given. Eligible preparations of opium for this disease, are paregoric, tincture of opium, pulv. creta comp. c. opio, and if there is no irritability of stomach, Dover's powder.

Astringents and often alkalies should be employed as adjuvants of the opiate. The chief danger is from the frequent watery evacuations, and both these remedies certainly aid materially in restraining them. These therapeutic agents may be given in combination, in formula such as are contained in our remarks on

the treatment of inflammatory and non-inflammatory diarrhoea. Astringents are less tolerated by an irritable stomach than either opium or chalk, so that it is often advisable to discontinue their use when they are vomited, in cases in which they would be very beneficial if the stomach were retentive. The opiate and alkali may be employed in the following combination:—

R.—Tinct. opii gtt. xij;
Mistur. creta ℥ss.
Mise.

One teaspoonful every two or three hours to an infant one year old. To this mixture an astringent may be added, as tincture of catechu or kino.

Billiet and Barthex prefer nitrate of silver as an astringent in cholera infantum, dissolved in distilled water. One of the liquid opiate preparations may be given at the same time.

By means of the opiate and astringent, if they are not vomited, the stools are generally in a few hours rendered less frequent and more consistent.

There are many physicians who believe that calomel given in small and repeated doses has a beneficial effect in choleraiform diarrhoea, but those who use it employ it in combination with opium, so that it is difficult to determine whether its effect is really beneficial. The theory of those who advocate the use of calomel, that it unloads the liver and increases the flow of bile, does not impress us favorably, since there is no evidence that this organ is in fault. But whether calomel is useful must be determined not by theory but by observation. Possibly it has a beneficial effect on the follicular apparatus of the intestines, which, so far as we can localize the disease, seems to be most in fault of any part of the digestive system. In a few cases in my practice, the fractional part of a grain of calomel given morning and evening, for two or three days, to infants previously in good health and robust, was attended by an improvement which may, however, have been due entirely to the opium and astringent which were simultaneously employed. In case of its employment, I would not recommend its use in larger doses than one-fourth of a grain, morning and evening, to a child of one year.

Generally, as the diarrhoea is relieved, the vomiting ceases. The opiate and alkaline remedies employed for the former are also curative of the latter; still the vomiting, if frequent and obstinate, sometimes does require special treatment, and there are

no better anti-spasmodic mixtures than those recommended in our remarks on the treatment of intestinal inflammation. In robust infants at the commencement of the attack, small pieces of ice taken in the mouth aid in diminishing the irritability of stomach. Mustard should also be applied to the epigastrium.

In most cases alcoholic stimulants are required. The best of these is Bourbon whisky or brandy, which should be used from an early period of the disease. Aside from its sustaining the vital powers, it aids also in relieving the irritability of stomach.

The diet in cholera infantum should be simple but nutritious. It should be given little at a time and often. If the infant nurse, it should be confined to the breast. If weaned, cold barley or rice-water should be given, with whisky or brandy, in the first stages of the disease, and afterwards milk or broths may be employed in addition.

If cholera infantum end in inflammation, the treatment already described for that disease should be adopted.

CHAPTER XI.

INTESTINAL WORMS.

THE belief has been prevalent in the profession, and is now in the community, that the presence of worms in the intestines constitutes a frequent disease in early life. As the pathology of infancy and childhood, and especially the means of diagnosing diseases are better understood, this idea is gradually abandoned by the profession. Still, intestinal worms must be considered an occasional cause of serious derangement or even disease, and of death also.

Worms, indeed, may exist in the intestines without any appreciable deviation in the individual from a state of health. Ordinarily, however, they in time give rise to symptoms so as to require the use of remedies for their expulsion.

There are five kinds of worms whose habitat is the human intestines, namely, the *ascaris lumbricoides*, *ascaris vermicularis*, or, as it is sometimes called, the *oxyuris vermicularis*, the *tricho-*

cephalus dispar, and two species of tenia. The *ascaris lumbricoides*, when matured, measures from five inches to about a foot in length. Young ones are sometimes expelled not more than two inches in length. The color is a reddish-brown, with a shade of yellow. The dead worm has a paler color. The females are much in numerical excess of the males, and their size is also greater. The worm in shape resembles the common earthworm, from which it derives the name *lumbricoides*. It is, however, more pointed at both extremities than the earthworm, and the color is a paler red. The tail of the male worm is curved, while that of the female is straight. The mouth is triangular, and is surrounded by three tubercles.

The *ascaris lumbricoides* resides usually in the small intestines. It occasionally enters the stomach, from which it is vomited, or it crawls up the œsophagus into the fauces, from which it is soon removed by the efforts of the individual. Cases are on record, one of which Andral witnessed, in which the worm entered the larynx, producing suffocation and speedy death. M. Tonnele, also, witnessed such a case. A child nine years old was suddenly seized with great difficulty of respiration and pain in the upper part of the chest. A careful examination of the thorax gave a negative result. Death occurred in from twelve to fifteen hours, and at the post-mortem examination a *lumbricoides* was found filling the cavity of the larynx. M. Blandin, also, witnessed a case, when interné of the Hôpital des Enfants. An infant was suffocated by one of these worms, which had penetrated as far as the right bronchus. Very rarely they crawl from the fauces into the nasal passages. This worm is so strong and active, that there is no reccus or reflexion of the mucous membrane of the digestive apparatus which it could possibly penetrate, in which it has not been found. It has been discovered in the appendix vermiformis, in the pancreatic duct, in the common bile-duct, and even in the gall-bladder. The number of these worms found in the intestines is very various. There may be only one, or the number may be almost incredibly large.

Thus, Barrier relates the case of an infant thirty months old, who died in Hospital Necker. It was believed to be tubercular. Numerous tumors, which could be felt in the abdomen, were supposed to be tubercular masses. On making the post-mortem examination, the mesenteric glands were found healthy, but the

intestines throughout their entire extent were filled with lumbrici. The masses which, during life, were believed to be tubercular glands, were found to consist of worms. The cæcum, especially, was greatly distended by them. The intertwining or collection in balls of these worms constitutes, indeed, one of the chief dangers, as it renders them so much the more difficult of expulsion.

The round worm, as this worm is commonly called, possesses no organs of penetration, still, if the intestine is weakened by disease, especially by ulceration, it may, by pressure with its head, force an opening through which it escapes into the cavity of the abdomen, causing peritonitis and death. This worm is often found, whether single or in masses, surrounded with a mucus, which serves as a partial protection to the intestines.

The portion of the mucous membrane in contact with lumbrici, is often found inflamed, either from movements of the worm, or from pressure of a mass of worms, or even of a single worm in a confined position, as the appendix vermiformis. This inflammation, continuing and increasing, may end in ulceration, and thus a weakened spot be produced, which may be ruptured by simple pressure of the mouth of the worm. In this way are, probably, to be explained those apparent cases of perforation, which have led some observers to believe that lumbrici had actually the power of penetrating the healthy coats of the intestines.

M. Guersant describes a case in which the appendix vermiformis was found with an opening through which two lumbrici had partly passed into the abdominal cavity. The effect of their impaction in this narrow cul-de-sac was much like that of a bean or a seed lodged in the same situation.

Lumbrici are sometimes found in a most remarkable situation, namely, in little abscesses, external to the intestines, situated generally in the abdominal walls. These, after a time, in some instances, open externally, discharging pus, one or more worms, and perhaps a little excrementitious matter. They result from an opening in the intestine, through which the worm has passed, producing circumscribed inflammation and an abscess, and the intestine, now relieved of the irritant, heals before the abscess reaches the surface.

The mucous membrane in contact with the worm, sometimes

presents the natural appearance; in other cases, it is red, being evidently inflamed.

The *Oxyuris vermicularis*, or *Oxyuris vermicularis*, or, as it is termed in the vernacular, the threadworm, is also frequent in childhood, and is the cause sometimes of much suffering, though generally of less dangerous symptoms than the round worm. Its habitat is the large intestine, commonly the rectum. Brown states that he found it even in the cæcum. This worm resembles pieces of white thread, and hence its common name. The female is larger than the male, measuring about half an inch in length, while the length of the male is not more than two or three lines, and it is proportionately more slender. It exists often in vast numbers in the rectum, from which it is expelled with the excrementitious matter. The head of the worm is blunt, and is furnished with a transparent vesicle. The tail is very slender, terminating in a spiral in the male, while it is straight in the female. These worms multiply rapidly, and they move actively their anterior extremity. In girls they sometimes enter the vagina, producing a leucorrhœal discharge.

The *Trichocephalus dispar*, or the long threadworm, is also found in the large intestine, but oftener in the cæcocoli or ascending colon than elsewhere. It measures in length one and a half inches, sometimes even two inches. The anterior two thirds are slender, resembling in size and appearance a hair, whence its name *trichocephalus*. The posterior third is considerably larger than the anterior, being like the *Oxyuris vermicularis*, spiral in the male, and straighter in the female. The worm is of a light color. Children are less frequently affected with the *trichocephalus* than with the two kinds just described. It rarely, if ever, produces any symptoms or does any appreciable injury.

The *Tænia*, or tapeworm, is much less frequent than the round or threadworm. There are two recognized species, the *Tænia solium* and *Tænia lata*. These worms have minute heads, which are different in the two species. Their bodies consist of white flat segments, which are united in a different manner in the two species. These segments near the head are small, as if rudimental, but as the distance from the head increases they enlarge, till their full development is attained. They are quadrilateral, having, when fully developed, greater length than breadth in the *Tænia solium*, greater breadth than length in the *Tænia lata*.

The *tenia* is an hermaphrodite, each segment containing the reproductive organs complete. The oviduct opens in the centre of the flat surface in the *tenia solium*, upon the edge of the segment in the *tenia lata*.

The *tenia* attains a great length, though the exact length is not fully ascertained, as pieces are generally detached and expelled from time to time before the removal of the entire worm. The *tenia lata* is supposed to attain the length of about fifteen feet. The *tenia solium* is considerably longer.

The *tenia* is rare in early life. Most practitioners never meet a case of it in children; still, there are such cases on record. Rosen and Bremser report cases between the ages of six and eleven years, and Hufeland, one at the age of six months. Wawruch collected 206 observations of *tenia*, in 22 of which the age was less than fifteen years; the youngest was a girl of three years. A most remarkable case of *tenia* is reported in the *Gazette Mèdicale* of Paris in 1837. M. Muller was called to treat a foster child five days old for slight constipation. The herbs were evacuated by the use of rhubarb, manna, and a few grains of salt, and in the excrement a foot and a half of *tenia* were discovered. This worm had evidently existed during the fetal life of the infant.

CAUSES.—The vermicular disease is much more common in one locality than another. Thus, in Paris, there are few cases, while in the provinces of France and many other parts of Europe, it is a common affection. It is more common in this city among the children of the poor than those in the better walks of life.

In the same region, with an identity of regimen, pursuits, and customs, it is sometimes common in one season, and rare in another. It is an interesting fact, also, as showing the influence of local causes, which we often cannot appreciate that in countries where the disease prevails, the relative frequency of the different kinds of worms is often different. Thus, in England, Holland, Germany, the *tenia solium* is common, and the *tenia lata* rare, while the reverse is true of Russia, Poland, and Switzerland.

There is often some derangement or disease of the digestive system, which is favorable for the growth of intestinal worms. Thus, in cases of continued indigestion, accompanied by irritation or subacute inflammation of the mucous surface, with an excessive secretion of mucus, worms are apt to be generated,

which aggravate the primary affection. Children in the last stages of typhoid fever not infrequently pass lumbrici in the evacuations from the bowels.

It has long been a common and probably correct belief that the use of certain kinds of food favors the development of worms. Fruits in excess, food of an inferior quality, or but partially cooked, remaining an unusual time unassimilated in the intestines afford a *modus* in which worms are very apt to appear. The same may be said of saccharine substances, taken in too large quantity, or too frequently. An excess of food, even of good quality, is also a cause, since this gives rise to the predisposing condition of undigested nutriment in the intestines. The period of childhood is mentioned by writers as one of the predisposing causes. Both the round and threadworms occur oftenest in children between the ages of three and ten years. Under the age of three years and over that of ten the liability to the verminous disease gradually diminishes.

During the last nine years, I have witnessed a large number of post-mortem examinations in the institutions for infants and children of this city, and although the intestines in a large proportion were carefully examined, I do not recollect ever having seen worms in one, who had died under the age of one year. The plain and simple diet of these institutions may account in part for the immunity of these young infants, but only in part. The infrequency of worms in the first year of life is an important practical fact. The immunity is greatest, for obvious reasons, in those who are nourished entirely or almost entirely at the breast.

In this city, children of the poor, living in almost total disregard of sanitary requirements, are especially liable to worms. This is attributable in a measure to the character of their food, which is often of inferior quality and poorly prepared, and partly, also, to the filthy and insalubrious state of the domiciles and streets in which they reside, and the consequent cachexia. One of the older writers remarks that intestinal worms, like coniferoid growths, thrive best where it is filthy and dark. Though such analogical reasoning is not to be accepted, the fact remains of the great liability to worms of those children who reside in insalubrious and humid localities which are favorable also for cryptogamic vegetation.

SYMPTOMS OF LUMBRICI.—These are, in part, constitutional

or sympathetic, and in part local, due to the mechanical effect of these entozoa on the coats of the intestines. Writers, especially Rilliet and Barthéz, have described the symptoms supposed to indicate lumbrici with rainatness. Those of a constitutional or sympathetic character are the following: Features sometimes flushed, sometimes pallid, and sometimes of a leaden hue; lower eyelids swollen, and sometimes surrounded by a blue semicircle; thirst, nausea, or even vomiting, appetite diminished, or entirely lost; or, on the other hand, augmented; breath foul; papilla of the tongue red and projecting; pulse accelerated and irregular. Rilliet and Barthéz state that they observed this irregularity in a boy three years old, at the time he was passing a large number of lumbrici. The irregularity afterwards disappeared. Acceleration of the pulse is one of the most common symptoms of these worms. The popular idea of "worm fever" has indeed a foundation in fact. This fever is often remittent and mild, but occasionally it is persistent and intense.

The symptoms pertaining to the nervous system are important. In mild cases they may be absent, as when there are few lumbrici, and the child is robust, and over the age of five years, but in severe cases more or fewer of these symptoms are commonly present. They are dilation of the pupils, especially inequality of dilation, to which Mouro attached diagnostic value; strabismus, twitching of the muscles, clonic convulsions, somnolence, headache, neuralgic pains, delirium. Rarely chorea, deafness, and paralysis; it is believed, may result. (M. Bonollet, *Gaz. des Hépitaux*, 1867.) Hyperæsthesia of the abdominal surface was present in a case which I attended, and which subsided as soon as the lumbrici were expelled. Grinding the teeth in sleep, and picking the nostrils are symptoms to which families attach great value. Observations, however, show that, though sometimes due to worms, they more frequently have another cause.

The local symptoms or disorders, in other words, those having a mechanical origin, are colicky pains, experienced chiefly in the umbilical region; in some patients, simple non-inflammatory diarrhoea; in others, enteritis; and in others still, colitis; stools sometimes natural; in other cases, liquid but fecal; and in others still, mucus-sanguineous; flatulences. M. Davaine, at a recent period, made the important discovery that the feces of patients affected with worms contain the ova of the particular

species present, in large numbers. The ovum of the lumbricus is oval and granulated, while that of the trichocephalus is spherical, with a small projection at each end, those of the thread-worm oval and irregular, and those of the tænia round. These ova can be seen through a lens magnifying 150 diameters.

In exceptional cases, there are local symptoms due to the presence of worms in unusual situations, such as a crawling sensation in the œsophagus; a sense of constriction in this tube or the pharynx; nausea and vomiting; a cough, especially if the worm has crawled to the upper part of the œsophagus; rarely the most urgent dyspnoea, and probable suffocation, if a lumbricus has entered the larynx.

The enteritis and colitis, to which these worms sometimes give rise, is ordinarily mild, but in rare instances ulceration occurs, which may be attended by profuse and even fatal hemorrhage. Occasionally very painful and dangerous constipation results from an accumulation of worms, in a ball or mass, too large to be expelled, unless with much delay and suffering, preventing the passage of fecal matter, and producing severe abdominal pain. The symptoms in these cases resemble closely those of intussusception. A marked example of constipation produced in this way, occurred in a family with whom I am acquainted, and who then resided in the interior of this State. A little girl of three or four years, was suddenly affected with obstinate constipation. The physicians prescribed active purgatives, calomel among others, and finally croton oil, and various injections, without relief. There was great pain, with distension of the abdomen, and death seemed inevitable, when, after the lapse of several days, a free evacuation occurred, and in the stool was a mass of worms firmly intertwined.

Children often have lumbrici without any appreciable impairment of the general health, but their presence may intensify the symptoms of intercurrent diseases, and greatly increase the danger. I have within six months attended two children of three and three and a half years, with pneumonitis, who, at the same time, had lumbrici, one passing in the course of a few days thirty, and the other twelve of these entozoa. Both presented well-marked physical signs of pneumonitis, and though they recovered, their symptoms were severe, being in one, if not both, aggravated by the intestinal affection. The one alluded to had convulsions

in the commencement of the inflammation, followed by profound stupor and amaurosis, lasting two or three days.

Occasionally the symptoms are associated with those of a co-existing pathological state. Thus, as we have seen, intestinal secretion of typhoid fever and of chronic diarrhoeal morbidities, affords a *sédes* for the growth of worms, and accordingly, at an advanced stage of these diseases, lumbrici are common.

The symptoms produced by the *ascaris vermicularis* are somewhat different. These worms do not usually cause the fever, disturbed digestion, the colicky pains, or the dangerous nervous symptoms which arise from the presence of lumbrici. Nor do they, like lumbrici, endanger life by crawling into unusual situations. Convulsions have been attributed to them, but such a result is exceptional if, indeed, the cause was rightly assigned.

The most common symptom produced by the *ascaris vermicularis*, is an intense itching of the anus. This is most intense at night when the child is in bed. It is sometimes absent during the day, but it returns so regularly at night, from the increased activity of the worm, that it has even been mistaken for a periodical nervous affection, and treated as such by quinine. So eminent a physician as M. Cruveilhier confesses that he has made this mistake. The itching sometimes leads to onanism, and in the female child the *ascaris* occasionally may pass from the rectum to the vagina, where it gives rise to leucorrhœa.

The *trichocephalus dispar* and the *tenia* are as rare in childhood, that few physicians ever meet a case. The *trichocephalus* is said by some to produce no symptoms. The symptoms produced by the *tenia* in children are not different from those in the adult.

DIAGNOSIS.—Bernier long since made the remark, and it has been repeated by most writers on diseases of children, that there is no pathognomonic sign or symptom of verminous disease, except actually viewing the worm. Late microscopic investigations have revealed, however, a pathognomonic sign, namely, the presence of ova in the feces. Not only the nature of the disease, but the species of the worm may be ascertained by this means.

The symptoms and disorders produced by lumbrici may all occur from other causes. Still, if several of them are present, and a careful examination discloses no other cause, the presence

of worms should be suspected, provided the child is over the age of two or three years. The microscope may then be used for diagnosis. A little tentative treatment, entirely safe to the child, will also determine whether the suspicion is correct. One or two doses of medicine, administered under such circumstances, like the surgeon's exploring needle, may reveal the nature of the disease, and indicate the means of cure.

In case of the *ascaris vermicularis*, the itching directs attention to the anus as the place of the disease, and here the offending cuticula may often be discovered by the eye.

PROGNOSIS.—Intestinal worms produce a fatal result in but a small proportion of cases. The *ascaris vermicularis* never does, unless in rare instances, through convulsions. The manner in which death may be produced by *hamulic* has already been pointed out.

In general, when the nature of the disease is ascertained, the worms are readily expelled by treatment, and the patient restored to health. If then there is no complicating disease, the prognosis is good.

TREATMENT.—Much injury has been done to children by the use of anthelmintics occasionally employed by physicians, but oftener by parents before the physician is called. Medicines of this kind are usually irritants, and in many of those diseases, which simulate the verminous affection, but are distinct from it, there is already an irritated, if not an inflamed state of the intestinal mucous surface.

Vermifuges administered under such circumstances obviously do harm, and in all acute diseases in which they are not required, even if their action is harmless, their employment is to be regretted, since it consumes time which is very precious. It is thus that many lives are lost by the use of anthelmintic nostrums, which are extensively advertised and which command a ready sale, since the belief in the presence of worms as a frequent cause of disease pervades all classes of the community.

A safe rule, followed by many physicians, and it would be much better if it were general, is not to give anthelmintics unless the child has passed one or more worms, or their ova are found in the feces, and not then if all the symptoms seem to be referable to a coexisting disease. In doubtful cases, in which the symptoms

resemble those of worms, a purgative dose of calomel or calomel and rhubarb may be employed. It will generally bring away one or more lutebrici or a mass of *ascaris vermicularis*, if either species of intecoon is present. This may be safely employed if there is no previous diarrhoea or debility. If after one or two doses and a free purgation no worms are passed, anthelmintic remedies should not be given, for it is almost certain that no worms exist.

A large number of medicines have, or have had a reputation as anthelmintics. *Santonina*, the active principle of the European wormseed, is one of the best, and is much employed in this country and in Europe. It is nearly tasteless; it may be given in powder, spread on bread with the butter. It is kept in the shops in one or two grain lozenges, sometimes mixed with calomel. It has the advantage of easy administration, and is destructive to both the round and threadworm. M. Bouchut considers it preferable to all other remedies in the treatment of the round worm. "To children two years of age he administers it in doses of ten centigrammes (2.39 grains), and in patients above this age, the quantity is increased by five centigrammes (1.15 grains) for every additional year." He gives in addition occasional doses of calomel or castor oil. In this country santonin is usually administered in one to three or four grain doses, two or three times daily, with an occasional purgative. The purgative is required to aid not only in the expulsion of the worm but also of the ova. In overdoses santonin causes vomiting, diarrhoea, and altered vision, so that objects appear yellow, but in medicinal doses it is considered safe in ordinary cases. Other medicines are preferable if there are symptoms of enteritis. For many years the anthelmintic most employed in this country has been the pink-root, the root of the *spigelia marilandica*, an indigenous plant. This is so frequently given by parents that it may be considered almost a domestic remedy. It is apt to cause, if the dose be large, cerebral symptoms, as vertigo, dimness of sight, spasm of the facial muscles, stupor, and even convulsions. These effects less frequently occur if the pinkroot is given with a purgative, and it has been customary to administer it in combination with *seena* in an infusion. A half ounce of *spigelia* with an equal quantity of *seena* is macerated for two hours in a pint of boiling water, and then strained. For a child two or three years old, the dose

is half an ounce to one ounce. So popular has this vermifuge been in this country, that probably a majority of the native-born adults in the States recollect the nauseating doses of pinkroot administered by anxious parents. Pharmacy now provides us with the same medicines in a more convenient and acceptable form, that of the fluid extracts.

R.—*Ext. spigel* (℥j);
Ext. scann (℥ss).
 Misc.

One teaspoonful to a child from three to five years.

The official fluid extract of *spigelia* and *scanna* may be given in the same dose. Prof. Proctor recommended the addition of antimony to this extract.

R.—*Ext. spigel. et scann* (℥j);
Santonin gr. viij.
 Misc.

This is probably the best anthelmintic that can be employed for the destruction of the round worm in uncomplicated cases, and it is also very useful in treating the *ascaris vermicularis*. *Chenopodium* is also a good anthelmintic. It is effolent, and at the same time one of the safest in case the mucous membrane is inflamed. If there is abdominal tenderness, with stools too frequent, and thin, or mucous, and tinged with blood, I should prefer the *chenopodium* to most of the other vermifuges. To a child of three years five drops of the oil may be given three times daily. It may be continued for a longer period than would be safe for most of the other vermifuges. Twice a week, during its use, a mild purgative should be given, as castor oil, rhubarb, or magnesia, unless the bowels are open. It may be given dropped on sugar or in a mucilaginous mixture.

Dr. J. F. Meigs says: "I myself rarely give any other remedy than *wormseed oil* in slight and especially in doubtful cases, unless this has already been tried and failed. From my own experience, I believe that this remedy is all-sufficient in a large majority of the cases that occur in this city, as these are almost always of a mild character, and as it not only produces the expulsion of the parasites when they exist, but also acts beneficially upon the forms of digestive irritation, which simulate so closely the symptoms produced by worms. I am persuaded, indeed, that of all the cases that have come under my notice, in which it seemed probable

that worms might be present, none were expelled in nearly half, and yet the signs of disturbed health have passed away under the use of the remedy." . . . "The following is a very good formula for the administration of this remedy.

℞.—Ox. chrysoselli grs. ix. vel ʒi;
 P. E. Mastic ʒi;
 Syrup. simplis ʒi;
 Aq. mucosum ʒi. q. M.

Give a dessertspoonful three times a day for three days, and repeat after several days."

In most of protracted intestinal disease attended by an increased and vitiated secretion from the mucous surface, a state which often gives rise to worms, turpentine is one of the best anthelmintics. In fact, in some of these cases, there is no good substitute for it. For example, a boy of about ten years, attended by myself in October, 1864, had reached or nearly reached the fourth week of typhoid fever, when he passed from his bowels a large quantity of blood. He was previously emaciated and weak, and there had been, as is usual in such cases, considerable diarrhoea. The hæmorrhage was attended with great prostration, from which, however, he partially rallied by the use of stimulants. On the following day an equally severe hæmorrhage occurred, attended with coldness and great feebleness of pulse, so that death appeared imminent. Turpentine was now administered every six hours, a few lumbrici were passed, and the case thenceforth progressed favorably. The mechanical effect of the lumbrici on the ulcerated surface of intestine had probably given rise to the hæmorrhage. Turpentine may be given in doses of from five to ten minims three times daily to a child five years old. Sweetened milk or sugar in powder is a good vehicle for it, or it may be given in a mucilaginous mixture.

℞.—Spts. trebitath. rect. ʒi;
 Ol. linseed grs. v;
 Macil. gum arab.
 Syr. simplis. ʒa. ʒv;
 Aq. aris ʒi.—Misc.

Dose, one teaspoonful every six hours.

The following formula for the employment of this agent is recommended by Dr. Condie:—

- ℞.—Madr. gum acac. ʒij,
 Sacch. alb. ʒss,
 Spir. ether. nit. ʒij,
 Spir. trevisti. rect. ʒij,
 Magnes. calcinat. ʒij,
 Aquæ menthe ʒj.
 Misc.

It is useless to enumerate the many anthelmintic mixtures which have been extolled from time to time. Those mentioned above are the least nauseous, and will rarely disappoint the practitioner. One other antidote for the round worm should be mentioned, as it has been much used and is efficient, namely, cowhage. This consists of the bristles which cover the pods of the *mucuna pruriens*, a tropical plant. The pods are dipped in plain syrup of the ordinary consistence, and the bristles are scraped off with the syrup. When enough of the medicine is added to render the syrup of the consistence of thick honey it is ready for use. The dose is a teaspoonful every morning for three days, after which a cathartic should be administered. I have never prescribed cowhage, although it is not unfrequently ordered by physicians, and a popular nostrum consists chiefly of it.

Threadworms require different treatment. The anthelmintics described above have less effect on them than on the lumbrici. Still, they may be administered for the expulsion of the former, but rather as adjuvants to the main treatment. The main treatment should be local, consisting in the use of injections, since from the habit of this worm enemas will ordinarily reach and destroy it. The substances which have been successfully employed as enemata are salt and water, lime-water, a decoction of aloes, or a decoction of two cloves of garlic in milk. West recommends the injection of six ounces of lime-water and two drachms of tincture ferri chloridi. Trouessart uses a solution of the arsenite of soda:—

- ℞.—Sodæ arsenit. gr. j;
 Aqu. destilat. ʒxij.—M.
 For six enemas, one or two daily.

Threadworms in the rectum may also be destroyed by ointments containing mercury, as a drachm of mercurial ointment mixed with oil or melted butter, or five grains of calomel with the yolk of an egg. (Boischut.) After the expulsion of the worms patients often require tonic treatment.

CHAPTER XII.

GASTRO-INTESTINAL HEMORRHAGE.

Hemorrhage from the capillaries is more frequent in infancy than at any other period of life, whether it be due to the irregularity of the circulation and frequent congestions in the infant, or to the greater delicacy and feebleness of the minute vessels at this age. Hemorrhage, generally capillary, from the gastro-intestinal mucous surface, occurs sufficiently often in the child, and especially in the infant, to render it a disease of some importance. It is more frequent the younger the individual.

This hemorrhage occurs in three distinct pathological states: first, in the new-born infant from causes not fully ascertained; secondly, from a pathological state of the blood or the vessels in which it circulates, and which is often connected with purpura hemorrhagica; thirdly, from a local cause.

First Variety.—In 49 cases, which I have collected from different writers, the hemorrhage occurred in 35 under the age of six days, in 5 from six to ten days, and in 9 from ten to twenty days. Some authors cite cases which occurred at the age of several weeks, but hemorrhage into the intestines at so late a period cannot be due to any cause operating at birth, and it is proper to consider such as examples of one of the other varieties.

Passive congestion of the gastro-intestinal mucous membrane is not infrequent in the new-born. Billard speaks of twenty-five cases without hemorrhage which he has examined. It is not difficult to understand why hemorrhage occurs when there is hyperemia of the capillaries. Rupture of more or fewer of the capillaries, or transudation without rupture, is a common result of great congestion, whether active or passive.

The cause of the abnormal congestion of the gastro-intestinal mucous membrane, so common in the new-born, has been referred by writers to the previous health of the parents, to circumstances attending the birth, especially too prompt a ligation of the cord, to irritant matters in the intestines, to external violence, and to

the two opposite extremes, namely, a plethoric and a feeble state. In my opinion, the chief cause, in many cases, is the tardy or incomplete establishment of the respiratory and circulatory functions, which gives rise to congestion in the cavities of the heart and in the lungs, and, consequently, in the capillaries of the systemic system. Evidently, this congestion is most intense in the full-blooded. Billard says, of fifteen cases of intestinal hæmorrhage which he examined, most of them were remarkable for the plethoric condition of their bodies and the general congestion of their integuments. Some, on the contrary, were pale and feeble, as is common after abundant hæmorrhage.

In two infants who died soon after birth, and whose bodies I subsequently examined, there was apparently a plethoric state, which rendered the fatal result more certain, if it did not indeed produce it. In one of these, in addition to intense general congestion, meningeal apoplexy had occurred, although the birth of the child had been easy.

It is not difficult to understand in what way too speedy a ligation of the cord may be a cause of capillary congestion and hæmorrhage. At the moment of birth, the uterus is contracted, the placenta compressed, and if the cord is now tied, more blood remains in the vessels of the infant than if tied a little later. A little later, in consequence of the temporary cessation of uterine contractions, and the re-establishment of circulation in the infant, blood flows through the cord towards the placenta. The cord thus acts as a safety valve to the circulation. Any accoucheur who will take pains to witness the effect on the cord of the return of circulation, will observe what I have stated. Too speedy a ligation of the cord would not, however, be sufficient in the majority of cases to produce that amount of plethora which would give rise to intestinal hæmorrhage without other co-operating causes.

Tardy or incomplete establishment of respiration and circulation, which gives rise to intestinal congestion and hæmorrhage, may be due to disease of the heart or lungs, as stœlectasis or cyanosis, to feebleness of the infant, or to slow and difficult birth. In a large proportion of cases, however, the birth is easy. Thus, three of five patients with intestinal hæmorrhage, who were treated by M. Gualrin, were born of an easy labor, and the same was true of four infants observed by M. Kiwisch.

The second variety of gastro-intestinal hemorrhage, often occurs as a sequel of other and debilitating diseases. I have known it to occur as a sequel of measles, smallpox, scarlet fever, and in one case of typhoid fever. One of these patients, when apparently the period of danger was passed, began to lose blood from nearly all the mucous surfaces, from the nostrils and gums, as well as intestines, and the case, which but for the hemorrhage would doubtless have had a favorable issue, terminated finally in less than a week.

Patients with this variety of gastro-intestinal hemorrhage sometimes present the macule of purpura, and commonly their aspect is pallid and cachectic. The following was a fatal case of hemorrhage occurring from the ileum, in a mild form of purpura hemorrhagica:—

CASE.—An infant, eight months old, of healthy parentage, nursing, with no previous sickness, and fleshy, vomited a small quantity of blood on the 25th of March, 1865; soon after it passed a stool consisting of almost pure blood. On the following day five or six patches of purpura hemorrhagica were observed on the arms and legs. These macule continued till death. There was no more hæmatemesis, but the stools, which were from two to four daily, consisted largely of blood. Death occurred from exhaustion on March 31st.

Section of the body.—Head not examined; thoracic organs healthy, but pale; liver fatty; stomach, upper part of small intestines, entire colon of normal appearance, unless presenting a somewhat lighter color from deficiency of blood; mucous membrane in the ileum to the extent of several inches, intensely injected without thickening. The blood had obviously escaped from this portion of the intestine, and a moderate amount of this fluid was found in the tube below the point of vascularity. This case is interesting not only on account of the development of purpura hemorrhagica, but the subsequent interest in a nursing child, apparently of healthy parentage, and without previous sickness.

In our remarks on internal convulsions, the case is related of a scrofulous infant who, to all appearance in her ordinary health, suddenly became affected with intestinal hemorrhage in connection with external and internal convulsions. A point of interest in this case was the relation of the hemorrhage to the neurosis. In one of the three cases of intestinal hemorrhage described by West, there were also convulsions. In rare instances there is an hereditary hemorrhagic diathesis to which the melæna is attributable. In the *New York Journal of Medicine and Surgery*, July, 1840, Prof. Swett relates the history of a hemorrhagic

family. Seventeen ~~one~~ of eighteen children of this family had died of hemorrhage of one form or another, and the survivor had epistaxis and melæna.

In the third variety, among the local causes producing hemorrhage may be mentioned alteration as in typhoid fever, or in severe intestinal inflammation, the mechanical effect of solid substances, lumbrici, invagination, obstruction to the portal circulation, polypus of the rectum. Occasionally at the post-mortem examination of young infants I have found blood with mucus in the duodenum and jejunum, these portions of the intestines being at the same time intensely congested. In one case of protracted enterocolitis occurring in the summer season, I found many small circular ulcers in the colon, nearly all containing points of extravasated blood. Such are the principal local causes of hemorrhage from the bowels. Ordinary colitis may also be considered a cause, although the amount of blood evacuated in this disease is commonly small.

Of the three forms of intestinal hemorrhage described above, that arising from local causes is most frequent, while that occurring from a purpuric or hæmorrhagic diathesis is least frequent. In rare cases fatal intestinal hemorrhage may occur in the newborn, and the blood be retained in the intestine, or if passed, it may so closely resemble the meconium that its true nature is not discovered. M. Bednar relates the following case (*Krankheiten der Neugeborenen*): "On the eleventh day after birth the boy's skin (then of a pale yellow color) diminished in warmth, the impulse of the heart became dull and prolonged, and the respiratory murmur scarcely perceptible. The child lay almost motionless and slumbering. The day following the surface could scarcely be kept warm, and the little patient had to be aroused to suck. On the twentieth day after birth it died. The brain was found to be anæmic, the lungs plethoric, whilst blood was effused into the duodenum and stomach."

Melæna is more frequent than hæmatæmesis. The hemorrhage, except when produced by a local cause, is usually from the small intestines. The blood, unless it comes from a point near the anus, as the rectum or descending colon, is commonly dark, and sometimes partially decomposed, emitting an offensive odor. Admixture of the blood with the intestinal secretions prevents coagulation of the fibrin.

Gastro-intestinal hemorrhage in itself produces few symptoms aside from the prostration which attends all hemorrhages. The disease with which it is associated may give rise to many and severe symptoms.

PROGNOSIS.—The result in the first and second varieties is much more unfavorable than in the third. Many new-born infants afflicted with gastro-intestinal hemorrhage die, but some recover. Billard attended fifteen fatal cases. It is probable, however, that death in the first variety is often due more to some coexisting lesion than to the intestinal hemorrhage. Meningeal apoplexy and the incomplete establishment of the circulatory and respiratory functions, may both operate as direct causes of death in this variety.

In the second variety, also, a very guarded prognosis should be given; so great a change in the circulatory system as to cause rupture of the capillaries, or transudation of blood in the ordinary course of the circulation, is a serious state. When this hemorrhage occurs as a sequel of the eruptive fevers, or in purpura hæmorrhagica, the patient is more apt to die than recover.

In the third form of intestinal hemorrhage the result depends on the nature of the cause, whether it is susceptible of removal. The majority of cases in this variety recover.

TREATMENT.—Billard recommends as a means of preventing capillary congestion and hemorrhage in the new-born, to allow a little blood to escape from the umbilical cord before its ligation, if the establishment of respiration and circulation is difficult or incomplete. This relieves the hyperæmia of the internal organs and facilitates the flow of blood. After the commencement of internal hemorrhage and the appearance of bloody stools, the same may be done if plethora is indicated by the florid and robust appearance of the infant, and the cord is not too much shrivelled.

The treatment, both therapeutic and regimenal, of intestinal hemorrhage should vary according to the age and state of the infant, the profuseness of the hemorrhage, and the nature of the cause. Perfect quietude, in the recumbent position, is requisite in all severe cases. Derivation to the extremities should be procured in the young infant, by heated dry flannel or flannel wrung out of hot water; in the older infant, by the same, with the addition of mustard. The nursing infant should remain at the breast, being allowed, perhaps, in addition to the breast-milk, a

little cool barley or gum-water. Spoon-fed infants should be given food of the blandest quality, in the liquid form and cool. This is the proper diet, whatever the age, in the commencement of the hemorrhage. If there are evidences of exhaustion, cool beef-tea, or essence, and alcoholic stimulants, are necessary. It has been advised in certain forms of intestinal hemorrhage, to apply leeches over the abdomen or around the anus. This treatment would, in my opinion, rarely be useful, but, on the contrary, in most cases, injurious. Hemorrhage from a mucous surface, when once established, will generally quickly relieve the local hyperemia, and leeching, unless very cautiously employed, would promote the prostration, in which the real danger in this disease consists. On the other hand, moderate counter-irritation over the abdomen may be attended with real benefit as a derivative.

The therapeutic treatment consists mainly in the use of astringents; in general vegetable astringents, especially those containing gallic acid, are preferable. Of the mineral astringents, acetate of lead and nitrate of silver have been used, but of late preference is given by the profession to the liquor ferri subsulphatis. It is preferable to all other astringents in gastric hemorrhage, and perhaps, also, if the hemorrhage is from the upper part of the small intestine, but it is believed to be decomposed in its passage through the intestine, so that it has less astringent or styptic effect, except in or near the stomach, than gallic acid. It is hardly admissible as a remedy in hemorrhage of the new-born. It may be given to a child five years of age, in doses of two or three drops in sweetened water or in mucilage.

Astringent enemata are sometimes useful. M. Billiet treated a case which recovered with enemata, each containing twelve grains of extract of rhatany, a strong decoction of the same astringent being applied externally to the abdomen. M. Bouchut recommends "cold water externally to the abdomen, internally by the mouth, or by enemata frequently repeated. These enemata should be composed of two or three large spoonfuls only. They may be rendered more active with three grains of tannin, or with seven grains of the extract of rhatany, or seven grains of catechu, or, lastly, with one grain of nitrate of silver. In this latter case, a small glass syringe and distilled water must be used, to avoid the premature decomposition of the medicine."

In the hemorrhage occurring in purpura, or after exhausting constitutional diseases, tonics should be given in addition to astringents. In chronic inflammatory disease of the intestinal mucous membrane, attended by a vitiated secretion of the follicles, the hemorrhage may be best treated by turpentine. I have elsewhere related two cases of recovery by the use of this agent, in one of which (typhoid fever) lumbrici were expelled.

If the hemorrhage is due to a local cause, as lumbrici or a rectal polypus, the treatment obviously should consist in the removal of this cause.

CHAPTER XIII.

INTUSSUSCEPTION.

INTUSSUSCEPTION, or the passage of one portion of intestine into another, has long been known as an occasional accident. Hippocrates, though deterred from the study of morbid anatomy, appears to have had a pretty clear idea of this lesion, and his practical mind suggested a mode of treatment which is essentially the same as that pursued at the present day.

Simple Intussusception.

This is not properly a disease. It consists in a displacement without any other anatomical change. There is, therefore, no obstruction, inflammation, or even congestion present, and no symptoms. This form of invagination might ordinarily be reduced by the normal peristaltic and vermicular movement of the intestine.

Invagination of a portion of the small intestine into the part immediately below it is often observed at the post-mortem examination of young infants, who had presented no symptoms due to the displacement. The invaginated mass is usually from half an inch to two inches in length, and, as a rule, this accident is multiple. There may be ten or more distinct intussusceptions, at distances of a few inches from each other. This simple displacement is believed to occur sometimes at the moment of dissolution. It has been thought by some to be most frequent in those who have

died of cerebral or spasmodic diseases, but its occurrence is not unusual in other pathological states. I have often found it at the post-mortem examination of infants who have had subacute or chronic enterocolitis. Heyn states that he has seen it at the Salpêtrière over three hundred times. Billard has seen it, especially in infants who have been subject to constipation. Any irritant, mechanical or other, which disturbs the regular movements of the intestines, doubtless may produce it. We learn, from good authority, that it can be caused in the rabbit by irritating the anus. It is, therefore, probable that the thread as well as round worm, by its mechanical effect, may operate as a cause.

It is not improbable that simple intussusception occasionally occurs temporarily in children whose health remains good, when the regular movements of their intestines are disturbed by irritating ingesta or other causes. This form of displacement never takes place in the large intestine. Its usual seat is the lower part of the jejunum, and upper part of the ileum. As it possesses little interest as regards pathology, and none whatever as regards symptomatology and therapeutics, it may be ignored in our description of intussusception.

Intussusception with Symptoms.

Intussusception, invagination, or volvulus, is one of the most painful and dangerous of human maladies, but fortunately not of frequent occurrence. I possess the records of fifty-two cases, which are tabulated in the Appendix (C); and from which the principal facts contained in this paper are derived. The patients were under the age of twelve years. The statistics furnished by these records, therefore, relate to both the periods of infancy and childhood.

PREVIOUS HEALTH.—In thirty-four of the fifty-two cases, the state of the health previously to the invagination was recorded. From the following table it is seen that half, or seventeen, were previously well, the remaining half suffering from some disease or derangement:—

Age.	PREVIOUS HEALTH.	
	Well.	Disease or Derangement.
One year or under	15	8
Over one year	2	9
	17	17

MM. Billiet and Barthex, whose views in reference to intussusception are derived from the examination of the records of twenty-five cases, state that the previous health is ordinarily good, and the disease is, therefore, primitive. Their remark, according to the above statistics, is seen to be correct as regards patients under the age of one year, but incorrect for those over that age.

Most of the seventeen who had previous ill health, had diarrhoea, dysentery, or constipation, or diarrhoea alternating with constipation. Of those otherwise affected, one had thrush, one two obscure abdominal pains, one nausea and vomiting, and one four months old had symptoms of invagination, at the age of ten weeks, which soon passed off. It is seen that the pre-existing affections were ordinarily such as would be likely to accelerate the movements of the intestines and at the same time render them irregular.

CAUSES.—The above statistics, therefore, show that in a pretty large proportion of cases of intussusception, there is previous disease of the intestine or derangement of its function. This, doubtless, is a cause of the displacement in at least a certain proportion of cases. It is proper to attribute a causative relation to the diarrhoeal maladies, and constipation, inasmuch as they have been found to precede the displacement in so many instances. From the records, it is probable that invagination may be caused by the irritation of intestinal worms. They were present in three of the fifty-two patients, though two of these seemed perfectly well till the occurrence of the invagination. The other patient, immediately prior to it, complained of soreness around the navel, and *ascaris* were found on examination.

The use of irritating and indigestible food is regarded by writers as an occasional cause. Thus, some who have had intussusception, have been in the habit of taking fruits, candies, and pastries freely. Such ingesta may be an immediate cause or a remote cause giving rise to diarrhoea, which, in turn, produces intussusception.

Billiet and Barthex consider the sex a predisposing cause. There are more male than female children affected with intussusception. Of the twenty-five cases collated by them, all but three were boys. In our own collection, the sex of thirty-four of the patients was recorded, and of these twenty-three were boys.

In rare cases external violence is the only apparent exciting

cause. One patient (No. 37, Appendix) received a severe contusion of the abdomen two years before death, and from this time continued to complain at intervals of pain in the bowels. One writer also mentions the case of a child nine years old who received a blow from a comrade at school, and from this time had alternately diarrhoea and constipation till the invagination commenced. Billiet and Barthex also relate the case of two children who were taken suddenly with invagination when their parents were tossing them in their arms.

Age.—Of the fifty-two cases constituting our collection, the ages were as follows:—

3 were 3 months old,	1 was 16 months old
12 " 4 " "	1 " 11 " "
2 " 5 " "	1 " 11 " "
5 " 6 " "	2 were from 1 to 1 years old
1 was 7 " "	8 " " 2 " 3 " "
1 " 8 " "	4 " " 3 " 12 " "
1 were 9 " "	3 not given.

There were, therefore, no cases under the age of three months, 25 cases between the ages of three and six months, or nearly one-half of the entire number, 8 from the age of six months to one year, and only 18 between the ages of one year and twelve. These statistics correspond, in the main, with those of Billiet and Barthex, in whose collection of 25 cases there was no one under the age of four months.

The great liability to intussusception in infancy is due partly to the anatomical character of the intestine in this period of life, and partly, doubtless, to the fact that there are more frequent irregularities in the intestinal movements than in older children. In the infant the walls of the intestines are thin, the mucous, muscular, and fibro-cellular structures being much less developed than in those that are older; the secondary and meso-colon have also greater depth as compared with the same in other periods of life, except the meso-colon at the points where it passes over the kidneys, in which places it is very short, or even in some cases nearly absent. Moreover, the space occupied by the large intestine, in which part of the digestive tube intussusception commonly occurs, is much shorter relatively to the length of the intestine than in those that are older. In about thirty measurements, which I have made of the length of the large intestine and the space occupied by it, the latter was found, in the average, about one

third part of the former, which, of course, necessitates doubling of the intestine on itself. These peculiarities of structure in the infant obviously favor the occurrence of intussusception.

SEAT AND PATHOLOGICAL ANATOMY.—While the simple or reducible variety of intussusception is usually multiple, the irreducible form is ordinarily single. Two exceptional cases will be presently related. In one case in our table there was a reducible in addition to the irreducible invagination.

While the simple variety is seated in the small intestine the seat of the irreducible form is, with rare exceptions, the colon. The colon constitutes the entire invaginated mass, or else, and more frequently, it forms the exterior of the volvulus, the incarcerated portion consisting wholly or in part of the ileum.

Intussusception in the Small Intestines.

Bouchard says: "M. Rilliet states, in a recent treatise, that in infancy the intestinal invagination is always accomplished at the expense of the large intestine, and that there is never invagination of the small intestine. This is incorrect. I have observed the small intestine invaginated in the adjacent inferior part. Taylor has reported a case of this kind in a child twenty months old, who died after an attack of acute peritonitis. M. Marage has seen another case in a child thirteen months old, who recovered after having voided the invaginated portion furnished with two of those diverticula, so frequent in the small intestine of the fetus."

But from all that appears, the case reported by M. Marage may have been, and probably was, an example of the common form of intussusception, namely, of the ileum into the colon. I am not certain what case observed by Mr. Taylor is alluded to, but if it is No. 18 of our table, as is probable, we see that the invagination was really of the ileum into the colon, although a small portion of the ileum next to the valve had not been inverted, and constituted a little of the exterior of the mass.

Intussusception, irreducible and fatal, may, however, occur in the small intestines in infancy as well as childhood. Probably the displacement is at first of the simple variety, but continuing and increasing in extent, its return becomes impossible. The positive statement of so great an authority as M. Rilliet, that

irreducible intussusception does not occur in the small intestines justifies the publication of the following cases, which establish the fact that there are rare instances in which the disease does have this location.

CASE I.—Male. This patient's health had been uniformly good, and nothing unusual was observed in his condition till the age of four and a half months, when he became restless as if in almost constant pain, with occasional exacerbations. Castor oil was prescribed, which operated freely, and then the following mixture:—

R.—Margar. calcinat. ℞i;
Tinct. opii camphor. ℥i;
Tinct. assafoet. ℞ss;
Aq. acid. ℥i.—M.

Dose, ten to twenty drops, repeated according to the pain.

These remedies failed to give relief, as did also chloroform given in doses of two drops. After two or three days, another set of symptoms arose, those characteristic of pneumonia, namely, hurried respiration, accelerated pulse, short, suppressed cough, and expiratory noise. He was treated with the oiled-silk jacket, and mild counter-irritation, and took an expectorant mixture containing carbonate of ammonia. In a few days the pulmonary disease was evidently subsiding, but the pain in the abdomen, with occasional exacerbations, continued. His countenance was pallid, and bore an expression of suffering. There was no distension or tenderness of abdomen, and no abdominal tumor. He took little nutriment, and seldom vomited. In the last part of his sickness the dejections were scanty, and the last three days his stools consisted mainly of mucus and a little blood. The pain seemed to be growing less, when he was seized with convulsions, and died the same day, precisely two weeks from the commencement of his sickness.

Secdis Cadaver.—Head not examined; body slightly emaciated; mucous membrane of trachea and bronchial tubes vascular; posterior portion of the lower lobe of each lung solid, of a greater specific gravity than water, and allowing only partial inflation; it was in the second stage of pneumonia. Stomach, duodenum, jejunum, healthy. In the upper part of the ileum was an intussusception two-thirds of an inch long, presenting no trace of inflammation, either within or around it, and its vascularity, when it was examined externally, did not seem notably increased. Above the intussusception the intestine was empty; below it, and chiefly in the small intestine, was a dark-colored substance evidently blood, and giving in a few hours the offensive odor of decaying animal matter. There was a passage through the intussusception, at least two or three lines in diameter, as shown by a probe. The intussusception sustained the weight of sixteen inches of the intestine, and it would apparently have sustained considerably more. The remaining organs were healthy.

CASE II.—F. S., a female infant, four months old, was treated at the New York Infant Asylum in June and July, 1865, for enterocolitis, the usual epidemic of the summer season. The following records show the state of the bowels immediately before her death:—

June 29th. Had five or six stools daily. 30th. Two stools in twenty-four hours. July 1st. Had two stools since the last record; no vomiting. 3d. Four dejections in twenty-four hours. 4th. The diarrhoea continues as before; dejections about four daily. On the 6th of July she died.

Her pulse during the time in which these records were taken generally numbered about 128 per minute. She was much emaciated, and the day before death she frequently smote her head with the hand. The medicines employed were mainly alkalies and astringents.

Scelus Cadaver.—Parietal leaves matted; serous effusion lying over the convolutions of the brain, under the arachnoid; occipital bone depressed; commencing at a point about two feet below the stomach were four intussusceptions two or three inches from each other. The invaginated masses were from one to one and a half inch in length, and three of them were found to be very vascular in their interior. Above, between, and immediately below the intussusceptions the intestine was healthy. One of the invaginations was tested by weight, and it was found to sustain one and a half foot of intestine, and would have sustained more. Water poured above these intussusceptions escaped through them very slowly; no flaccid exhalation; descending colon vascular and thickened, and solitary glands enlarged.

The irreducible character of the intussusceptions in the above cases was shown by the fact that they sustained weights which doubtless produced greater pressure than that exerted by the intestine in its normal action. That the displacement existed prior to the moment of death was shown not only by the symptoms in one case, but by the anatomical changes which had occurred in both. In one the capillaries of the incarcerated mass were ruptured during the last days of life, so as to produce sanguineous stools; while in the other there was intense congestion of the confined membrane, while that adjacent was healthy.

In both cases there was less violence of symptoms, and the disease seemed to come on more gradually than in the first and second cases of our table, in which the portion of intestine which was engaged was the same, but the patients older. In fact, the imprisoned intestine was pervious, so as to allow the passage of food in one through the entire sickness; in the other, till near the close of life. At the post-mortem examinations, the intestines were found empty above the intussusceptions, and water slowly passed through them.

It is my opinion that intussusception of the small intestines in the infant, commencing as the simple form, may become irreducible, and yet remaining pervious continue for weeks without giving rise to those severe symptoms which ordinarily charac-

terize this disease. The following case, which I have not thought best to include in my table, was apparently an example of this:—

CASE.—Male child, died at the age of nineteen months, the last eleven of which he was under observation. The mother states that he had never been well since the age of one month, and that there had been little variation in the symptoms of his disease. During the period in which he was under observation, he was ordinarily fretful, and frequently seemed to be in considerable pain. His stomach through this whole time was so irritable, that he rarely took more than three or four spoonfuls of nutriment without vomiting. There was usually more or less diarrhoea, but no tenderness or distension of abdomen. He grew slowly, but gradually more emaciated, and, finally, died in a state of extreme emaciation and exhaustion. He had no convulsions and was conscious to the last.

Seco. Cadaver.—Brain not examined; lungs healthy, except a circumscriptal portion, which was infamed at the summit of the right lung; liver small and almost destitute of oily matter, as shown by the microscope. In the jejunum, about two feet below the stomach, was an intussusception two inches long, the intestine forming which seemed to have undergone no structural change. Above the intussusception the intestine was of small calibre, and entirely empty and pale; below the intussusception the intestine was somewhat larger than above, but it seemed quite healthy. The invagination was sufficiently pervious to allow water to pass through it, and it readily sustained the weight of two feet of intestine. From eight to ten inches below this intussusception there was another, which was immediately drawn out the moment the intestine was disturbed. The other abdominal viscera were healthy.

There is uncertainty as to the duration of intussusception in the above case. Though the symptoms indicated that it existed a considerable time prior to death, yet there was no strangulation, nor indeed any appreciable anatomical alteration in the coats of the intestine. The fact that the volvulus sustained two feet of intestine, and required considerable traction for its reduction transfers the case from the simple to the irreducible variety.

Intussusception in Large Intestines.

In most cases of irreducible intussusception in infancy and childhood, the ileum is invaginated in the colon, or the first part of the colon is invaginated in the part succeeding it. By referring to the table (*Appendix*) it will be seen that intussusception not unfrequently begins in the prolapse of the ileum through the ileo-caecal valve, in the same way that prolapse of the rectum occurs through the sphincter ani. If death take place early, as in Case 6,

only a small portion of the ileum may have passed the valve. If the case is protracted, the tenesmus brings down more and more of the ileum, with its accompanying mesentery. The constriction of the valve, which acts as a ligature, soon prevents the further descent of the ileum, and the tenesmus continuing, the next step in the morbid process is the inversion of the caput coli, which is drawn into the colon by the descending mass, and unless the case terminate by sloughing or death, the ascending and transverse portions of the colon are successively invaginated. The records show that intussusception occurs as above stated in a large proportion of cases. In one case, No. 18, the intussusception began a few inches above the valve, so that the ileum constituted a small portion of the exterior of the mass. Occasionally the cecum is the part primarily inverted and invaginated, and descending along the colon, it draws after it the ileum, which sustains its natural relation to the ileo-caecal valve. When this occurs the cecum is found at the lower end of the mass, and two orifices are observed, one leading through the valve, and the other into the appendix vermiformis. In Cases 14, 17, 20, 21, 26, and 37 (Appendix), the intussusception evidently commenced with the caput coli. These two forms of invagination—that in which the ileum, passing through the ileo-caecal valve, successively inverts and draws after it the caput coli and the divisions of the colon; and that in which the caput coli is primarily invaginated, and descending along the large intestines, inverts the latter, and draws after it the ileum—constitute the vast majority of cases of this disease in infancy and childhood. In Cases 3 to 42, the parts invaginated were the ileum or caput coli, or both, generally with a portion of the colon. In one case, 44, the intussusception was in the transverse colon; in one, 43, in the descending portion; and in one, 45, in the lower portion of the descending colon and in the rectum. Barely (24, 33, and 37) double invagination occurs. The first invagination becomes arrested in its progress, and by the strong expulsive efforts of the patient, the whole mass descends into the portion of intestine below, forming a volvulus of great thickness, and necessarily fatal. In exceptional cases there is so little constriction of the invaginated intestine that it remains pervious, though with diminished calibre. In these cases life may be protracted for weeks or even months, the evacuations being sufficient for the wants of

the system. Death occurs, finally, in a state of exhaustion. Case 9 affords a notable exemplification of this. This child, four months old, lived six weeks after the symptoms of invagination commenced, and seventeen days "with a portion of the bowel protruding from the anus." It was found at the post-mortem examination that part of the ileum had descended through the entire colon, and had remained peritoneal. Case 37 affords another illustration of the same. It is not known at what time the invagination began in this case, though there were symptoms of it for seven months before death. During the last six weeks of life, the invaginated intestine protruded frequently from the anus, and was replaced by the mother. In this case "the cecum was inverted, and descended through the colon to the lower portion of the rectum, carrying with it the ileum and the entire colon, except the last ten or twelve inches." In Case 31 the symptoms indicated a continuance of the disease for three, if not eight, months. As the intestine becomes invaginated, its mesentery or meso-colon is also invaginated, and, with rare exceptions, its veins compressed. The pathological state of the incarcerated mass soon becomes that of intense congestion. In infants, usually in a few hours, so great is the distension of the capillaries that they give way, blood escapes into the intestine, which coagulates around the volvulus, and passes from the bowels in scanty motions. On examining the invaginated intestine after death, if gangrene has not occurred, it is found of a uniform intense red color, sometimes resembling a long and firm clot of blood. In those who die early there are no traces of inflammation, but in more protracted cases the attrition between the serous surfaces excites local peritonitis. In none of the fifty-two cases in which post-mortem examinations were made, did the inflammation extend more than a few lines beyond the invagination. Usually the intestine forming the exterior of the invaginated mass, is much drawn together or puckered. In the case treated by myself, 36, the entire large intestine which formed the exterior, was compressed within a space of six inches or less, since about twelve inches of the ileum doubled on itself, passed through the entire colon so as to protrude from the anus, the only part of the large intestine inverted being the caput coli. In Case 18, six or seven inches of the ileum, which formed a

portion of the exterior of the mass, were compressed within the space of one inch.

The abdomen, at first of natural fulness and soft, usually becomes more and more distended till the close of life; but in cases of much vomiting the distension is moderate. This fulness is due to gas and fecal accumulation above the invagination. The portion of intestine below it is generally empty, unless it contain a little blood, and is sometimes contracted.

There are few morbid changes in intussusception beside those pertaining to the intestine. Professor Simpson saw Case 51, and remarked before the medical society, at which the specimen was exhibited, that it appeared to him from the distended state of the omoticous veins, that the ascending vena cava was compressed by constriction at the point where the intestine had sloughed. In Case 40, there was probably compression of the left iliac artery; for two days after the expulsion of the caecum and a part of the colon which had sloughed, pulsation ceased in the left leg and all that part below the patella became gangrenous. The patient gradually recovered with the loss of the leg. The only probable explanation of such cases is that the bloodvessels are compressed by the constriction and contraction which follow the sloughing of the intestine such as occurred in Case 48. This child, on the eighth day of his sickness, lost by stool fifteen to eighteen inches of the ileum, after which he rapidly recovered. Twelve weeks later he was seized with typhus fever, which proved fatal in two weeks. The records state, "The traces of the diseased bowels were visible by a considerable puckering and contraction where the slough had taken place and the parts united." This case shows that the supposition that constriction in rare instances arrests the circulation and gives rise to gangrene receives confirmation from post-mortem inspection. In Case 40, although the caecum and a part of the colon contiguous were discharged, the seat of the invagination was probably the descending colon if not lower still, so as to correspond with the common or perhaps internal iliac artery. Whether or not this is the true explanation, the fact remains that in some cases of sloughing of invaginated intestine, the circulation in the large venous or arterial trunks of the abdomen is more or less obstructed.

SYMPTOMS.—The symptoms vary somewhat according to the age of the patient and the degree of strangulation in the part

invaginated. Pain in the abdomen, usually paroxysmal, is among the first, and is one of the most conspicuous symptoms. It is often severe, resembling the pain of hernia, and abating only with the failing strength of the child. After the first few days the pain is apt to be more or less continuous, arising from the presence of inflammation. At first pressure upon the abdomen causes no distress, but after a period there is tenderness. This is also due to the inflammation, which occurs in and around the invaginated mass. It is therefore confined to the part of the abdomen which corresponds with the invagination. At this point the abdomen is more full than elsewhere, and not unfrequently the physician can feel the invaginated mass and detect its exact location. Sometimes, at an early period as well as late, cerebral symptoms occur as in Case 8, which terminated in convulsions on the second day. Convulsions are, however, comparatively rare, and the mind is generally clear till the last moment. In infants the countenance, in the intervals of pain, in the first stages of the complaint, is often placid and not indicative of any serious disease. In older patients severe local symptoms, referable to the intussusception, commence as a rule immediately, and are continuous. At an advanced period in both, the countenance becomes anxious and haggard, the eyes hollow or sunken, the body loses its plumpness, and, if the case is protracted, becomes emaciated.

Vomiting is rarely absent; in thirty-nine out of forty-seven cases it is stated to have been present; in seven cases there is no record of this symptom, while it is recorded absent in only one case. This is Case 52, the record of which is very meagre, and death occurred the second day. The vomiting becomes stercoraceous in a few days, and it ordinarily continues with greater or less frequency till the period of collapse. It relieves partially the distension.

The appetite is usually impaired and often entirely lost. Infants at the breast commonly nurse, however, for several days, probably from thirst rather than hunger.

There is commonly one natural stool after the intussusception commences, and then obstinate constipation succeeds. This evacuation consists of the excrementitious matter below the invagination. In children under the age of one year, scanty motions of blood mixed with mucus begin to occur in a few hours. In twenty-seven children under this age I find that twenty-four had

such evacuations, occurring in most patients several times in the course of the day; in two of the twenty-seven there is no record of this symptom, but in the remaining cases it is stated to have been absent. Scanty evacuations of blood unmingled with fecal matter have been considered pathognomonic of intussusception in the infant, and we see the ground for such belief; but in rare cases the rectum may be partly pervious, and although the dejections may contain blood they are also excrementitious. In our collection of cases are three examples of this in infants under the age of one year. One has already been referred to. In this case there was the rare anomaly of so large an opening through the ileo-cæcal valve, as to allow not only prolapse and descent of the ileum through the entire colon, so as to protrude six inches from the anus, but also fecal passages through it daily.

In children above the age of one year, the capillaries of the invaginated intestine are not so frequently ruptured as under this age, and sanguineous evacuations are therefore less common. I have records of nineteen cases of invagination between the ages of one year and twelve, in only six of which is it stated that there were bloody motions. And in these six, the blood was not passed frequently, nor even in some cases daily, as in infants, nor in so pure a state, unless in Cases 9 and 11, the records of which are not explicit on this point. Two of these patients passed moderate bloody evacuations, after protracted periods of constipation; one had fecal discharges with the blood through the entire sickness, and in one, blood was passed at first, but finally the stools were entirely excrementitious.

In those above the age of one year, there was for the most part obstinate constipation, no dejections, whether bloody or fecal, occurring for several days. But there were a few exceptions. In Cases 7, 21, and 57, the bowels were relaxed. The ileum, in these three cases, had descended through the entire colon, or the larger part of the colon, and being pervious, the feces escaped from the anus, without detention in the large intestine, or with detention only in its lower portions, and were therefore liquid.

Tenesmus is another symptom. It is not always present, but in a large proportion of cases, even when the invagination is in the upper part of the large intestine, this is a frequent and distressing symptom. It often does not commence till there is a

considerable amount of displacement, and it ceases, when the strength is much reduced.

The surface is usually cool in the commencement of intussusception, but finally, as febrile reaction comes on, symptomatic of the inflammation, the temperature rises, and it continues above the healthy standard, till the intestine sloughs, or till the stage of collapse occurs, which usher in death. The pulse, especially in the infant, is sometimes tranquil at first, but whatever the age, it soon becomes accelerated from the paroxysms of pain, and subsequently from the inflammation which occurs in the invaginated mass. There is no disturbance of the respiration, except that it is somewhat hurried from the fever, and from the pain felt in advanced cases on full inspiration.

It will be seen that the symptoms vary in certain particulars, under the age of one year, from those occurring over that age, but differences in the symptoms depend more on the degree of invagination and constriction, than on the age and exact location of the disease.

DIAGNOSIS.—The diagnosis of intussusception is not, in general, difficult, except at its commencement. When the invagination has reached that degree at which obstruction occurs, the symptoms are, in most cases, such that the disease can be readily diagnosed. In the cases, the records of which I have collected, a correct diagnosis was, with few exceptions, made, and at an early period. In the infant, the disease for which intussusception is most frequently mistaken is dysentery, on account of the tenesmus and the mucro-sanguineous stools. In some of the cases which I have collected, this mistake was made until it was ascertained that purgatives produced no fecal evacuations.

The symptoms which characterize most cases and indicate the nature of the disease, are obstinate constipation, vomiting, paroxysmal pain referred to the seat of the disease and tenesmus. In the infant, also, scanty evacuations from the bowels of mucus and blood, or of pure blood, is an important diagnostic sign. It should be borne in mind, however, that in exceptional cases the displaced bowel may remain pervious, and the symptoms which possess so great diagnostic value therefore be absent. There may be no vomiting or tenesmus, and there may even be diarrhea in place of constipation. As an aid to diagnosis, it should be stated that whatever the age of the child affected with intussusception,

clysters are commonly given with difficulty, and are quickly and forcibly returned, on account of the resistance opposed by the invaginated mass. Moreover, the seat and even extent of displacement may be sometimes ascertained by a digital examination of the abdominal walls. The tumor can be felt hard, elongated, and tender on pressure. If the invagination be in the lower part of the large intestine, it can sometimes be discovered by an examination per rectum.

DURATION.—In the following table, the duration of the intussusception in forty-nine cases is given, as nearly as it can be ascertained from the records:—

2 died the 1st day.	1 died the 36th day.
6 " " 2d "	1 " " 10th "
14 " " 3d "	1 " " 14th "
2 " " 4th "	1 lived nearly a week.
2 " " 5th "	1 " (Case 9) 6 weeks.
2 " " 6th "	2 time of death not given.
2 " " 7th "	7 recovered.
1 lived over a week.	

In the three remaining cases, 4, 31, and 37, the exact duration is not certain; but it was probably far beyond the usual period. The second of these (31), a girl of six years, having eaten raw carrots was seized with pain in the abdomen, which lasted eight months, when she died. During the last three months she passed mucus and blood. In this case the caecum had descended to the anus, drawing with it the ileum, which remained pervious. The symptoms indicated the continuance of the invagination for three months if not eight. In the third case (37), the child complained of pain in the abdomen for many months, and occasionally vomited. During the last six weeks of his life, all the phenomena of invagination were present. The pathological condition of the intestine found after death was essentially the same in both cases.

In West's *Treatise on Diseases of Children* (fifth edition, 1896, page 504), it is stated that death in this complaint always occurs within a week. The above cases prove that this remark should be qualified, although a large majority do die within the first seven days. In thirty-three cases death was within the first week. In all fatal cases, in which strangulation was complete, death took place within eight days, the day of greatest mortality being the third. In these cases the average duration was 3.5 days. Death on the first day is rare, but it occurred in two instances.

When it occurs at so early a period it is often, if not generally, through convulsions and coma.

Intussusception is in its nature so grave an accident that the physician called to a case should always expect and predict a fatal result. A favorable issue is only through an unusual combination of circumstances. But while death is the common result, there are three different modes of termination in which life is preserved. First, the reduction of the incarcerated intestine, with immediate relief. There can be no doubt that it is possible for intussusception, when recent, to be reduced by the unaided action of the bowels, in the same way as the common simple intussusception in the jejunum and ileum, or as hernia is reduced, through the vermicular action of the intestines. For sometimes, as in Case 6, there previously have been the same symptoms as those which accompanied the fatal attack, and which subsiding, the patient remained for a time in perfect health. This termination is probably rare, if the symptoms are sufficiently marked to necessitate treatment. A considerable number of observations also establish the fact that intussusception may occasionally be cured by early and well-applied treatment. The physician may succeed in reducing the displaced intestine, even if the intussusception is in the upper part of the colon. Relief in these cases, whether by the unaided movements of the intestine or by the physician's art, is obviously immediate.

A second mode of favorable termination is alluded to by certain foreign writers. The intussusception continues for a considerable period with the characteristic symptoms, and then, as Bouchut expresses it, "the vomitings gradually cease, the intestinal hemorrhage disappears, the strength returns, and the health becomes restored without the expulsion of fragments of the intestine." What changes the displaced intestine undergoes in these protracted cases, which gradually recover without sloughing, have not been clearly ascertained, although they have been the subject of conjecture. According to Killist, a large proportion of favorable cases terminate in this manner. It does not appear, however, from the statistics which I have collected, that this is a common mode of recovery. The clinical history of intussusception establishes the fact that in a large majority of protracted cases there is either death, or the third mode of favorable termination, namely, by sloughing.

Infants with intussusception other than the simple form, which was described at the beginning of this paper, commonly die. The reason of this is obvious when we consider that at this age, in a few hours after the invagination begins, the imprisoned mass, with rare exceptions, becomes so engorged that its capillaries give way, and its reduction is impossible by any appliance of medical art. We cannot reasonably expect recovery except through sloughing and the expulsion of the intestine; and few infants have the requisite strength for so tedious and exhaustive a process. The youngest child that recovered in this way, so far as I can ascertain, was one reported by M. Marage, namely, an infant thirteen months old. With the exception of this case, the youngest was (42) a boy, five years of age. The older the child the greater of course the power of endurance, and the better the prospect of recovery. In our collection are the records of seven cases which resulted favorably by sloughing. These children were of the ages of five, six, six, nine, eleven, twelve, and twelve years. The separation of the invaginated mass occurred in six of these between the sixth and twelfth days, with an average of nine and a half days, the time not being given in one case. If, then, the patient can be carried through the first week without too much exhaustion, we may each day look for the discharge of the slough, the reopening of the bowels, and ultimate recovery.

In those rare cases in which there are daily fecal dejections, recovery is still improbable. At an early period reduction is no doubt more easy in these cases than when there is strangulation, but from the absence of strangulation the intussusception usually becomes greater, and sloughing is less likely to occur; so that although the case is more protracted, and the symptoms less severe, the result is almost necessarily fatal.

MODE OF DEATH.—In a large majority of cases death is through asphyxia. There may be convulsive movements, more or less marked, but the prevailing characteristic at death approaches is extreme exhaustion. In exceptional cases the life of the sufferer is cut short by convulsions before the stage of exhaustion is reached, as in Cases 2 and 6.

TREATMENT.—It is unfortunate, in cases of intussusception, that the time in which treatment can be of most service is apt to pass by, before the true condition of the intestine is detected. Invagination being comparatively rare, the patient is generally

on the first day treated for colic or dysentery or some other common affection of the bowels; and it is often not till the second day, when the intestine has become incarcerated, that the physician accurately diagnoses the disease. The purgative medicines usually given in the commencement are more likely to injure than to benefit. In fact, both reason and experience teach us the impropriety of such treatment in this complaint. Cathartic remedies act as a *vis à tergo*, and may cause a still further descent of the inverted intestine. Quicksilver has been much employed in the treatment of obstinate constipation, and it has been recommended in the treatment of this disease. It was administered in two doses of one ounce each in one of the cases, the records of which are in my possession, but none of the mineral passed the bowels. At the post-mortem examination a considerable part of it was found in small globules, coated with a black layer consisting of the sulphuret or black oxide of mercury. The employment of quicksilver must be strongly condemned. If the intestine is strangulated it would be retained above the intussusception and by its weight tend to increase it. Moreover, remaining in the system, it is soon converted into a substance which is readily absorbed and the effect of which must necessarily be injurious.

The proper treatment of intussusception consists in attempts at first to reduce the displacement by pressure from below. This pressure may be applied either by liquid injections into the rectum, or, which is better, inflation of the lower intestine by air or gas. If reduction is not effected after sufficient trial, the indication is to sustain the strength of the patient and give palliative remedies in the hope that recovery may take place through the process of sloughing and adhesive inflammation. If we may judge from the remarks of physicians who have reported cases, and by discussions in societies in which specimens have been presented, this mode of treatment is that ordinarily advised by the intelligent portion of the profession.

The medical journals contain reports of cases of intussusception successfully treated both by liquid injections and by inflation, but the latter is now commonly recommended, as it is believed to produce a more equable and effectual distension of the external or incarcerating portion of intestine and upward pressure of the internal or that which is incarcerated. Besides, cases of cure by inflation have been reported after liquid injections had failed.

The following communication to the *London Lancet* for March 17th, 1838, explains the ordinary method of employing air:—

"SIR: The subject of intussusception having lately been discussed at the two principal medical societies in London, and nothing new having been elicited on these discussions, I take the liberty of suggesting to the profession through the medium of your valuable periodical, the trial of inflating the bowels by means of a glyster-pipe attached to a common pair of bellows; it has fallen to my lot to witness several of these most distressing cases in children; the nature of the obstruction was foretold during life, and unfortunately verified by *post-mortem* examination. The last case of the kind which came under my care about two years since, presented all the usual symptoms: intolerable restlessness, the most obstinate sickness, the singularly distressed state of countenance, and shrunken features. The usual remedies were had recourse to, viz., warm baths, glysters, anodyne frictions over the abdomen, &c., but without avail. As a forlorn hope I made trial of inflation by the above means with the most happy result. The sickness immediately ceased; the child within an hour passed a natural stool, and in the morning was almost without ailment.

"I am, sir, &c.,

SAMUEL MITCHELL, *Surgeon.*"

This mode of treatment is termed novel in the *Lancet*, but it is as old as the time of Hippocrates, who speaks of throwing air into the bowels, by which flatulence is initiated (*flatus immittitur*) (*Hippocrates' Works*, translated from the Greek by Grim, 4 vol., page 168.) Haller also recommended the same treatment: "*Flatus citius inimicus celeriusque susceptionem dispellet.*" (*Physiologia Corporis Humani*, tom. vii. p. 25.) In the *Edinburgh Medical Journal*, October, 1864, Dr. David Greig relates five cases of successful treatment of intussusception by inflation. The first, an infant six months old, previously in good health, suddenly became very fretful apparently having severe paroxysmal pain in the abdomen. She had vomiting, and finally tenebrius, with bloody evacuations. Warm water enemata could not be administered on account, the writer thinks, of the spasmodic action of the intestines, and an abdominal tumor could be distinctly felt near the umbilicus. Castor oil and a purgative powder, and enemata of water having been employed in vain, and the case becoming really critical on

the second day, inflation was employed. The writer says: "The nozzle of a small pair of bellows was introduced into the anus, and air injected to a considerable extent. Contrary to our expectation, the air passed readily into the bowel, and seemed to give the child great relief. After the injection it lay very quiet, as if asleep, and evidently quite free from pain. In about twenty minutes from the time the air injection was administered a slight rumbling noise was heard in the child's abdomen, followed by a crack so loud and distinct as to alarm the attendants in the room, who thought something had burst in the child's bowels. The child, however, continued as if asleep and free from pain, and in about half an hour a large feculent stool, slightly mixed with blood and mucus, was passed without pain. During the night the child rested pretty well, had no return of vomiting, took the breast as usual, and in two days was quite well."

Another child nine months old, treated by Dr. Greig, presenting nearly the same symptoms and the abdominal tumor, also obtained relief by inflation, after castor oil and enemata had failed to produce any benefit.

An apparatus for the production and injection of carbonic acid gas has been invented by Schultz and Warker, of this city (112 East 14th St.), and is manufactured by them. It consists essentially of two glass chambers, one over the other. In the lower one a bicarbonate is placed, and in the upper an acid in a liquid state. By the gradual admixture of the two, carbonic acid is set free. An elastic tube conveys the gas from the lower chamber. This apparatus has been used by physicians of the city, for the reduction of intussusception and other purposes, and is recommended as a useful invention.

Whether air or carbonic acid is employed, it is necessary to produce distension of the intestine to its fullest extent below the seat of the complaint, without endangering rupture. The air or gas should be retained for a time, when, by the peristaltic movements, reduction may be effected. One advantage in the use of this agent over water is that the latter by its weight diminishes the extent and strength of the peristaltic movements. Water, like air, must be injected in considerable quantity.

Whether air, gas, or water is employed to effect reduction, the sooner it is used the better the chance of success. In the course of two or three days the inverted intestine has, in a large propor-

tion of cases, become so firmly incarcerated, and has descended so far, that attempts to replace it are unsuccessful; still, even at a later period, the attempt should be made, if it has not been previously tried.

When injection of water and inflation by air or gas has failed to relieve the patient, it has been proposed to cut down upon and replace the intestine, in the same way as the surgeon treats strangulated hernia, and this operation is said to have been successfully performed in the adult. If the tumor can be readily detected by external examination, if its position be favorable and the patient an adult, the propriety of such an operation might be seriously considered, but I apprehend that there are few surgeons at the present day who would perform or recommend this mode of treatment in the child. The child, and especially the infant, could hardly recover from the shock of so severe an operation, even if it escaped peritoneal inflammation. As an objection to the use of the knife is the important fact which distinguishes intussusception from hernia, that sloughing which finally occurs if life is prolonged, is conservative in the former, though fatal in the latter. After failing to return the intestine by the mode described above, active measures should be discontinued, and the treatment should be expectant. Recollecting that death is from asphyxia, and that after a certain time, if the strength holds out, adhesive inflammation occurs, and the mass which closes the intestine sloughs and is expelled, we should endeavor to sustain the vital powers by nourishment and stimulants, and relieve the pain by the judicious use of opiates. At this stage of the complaint there is local peritonitis between the coats of the volvulus, and this requires the administration of opium in some form. Sustaining and expectant measures ought to be adopted at an early period. The diet should consist of beef essence or other concentrated nutriment which leaves little residuum.

Vomiting, which is so constant, requires no treatment. It relieves the distension and prevents fecal accumulation, which pressing downwards, increases the extent of the invagination and counteracts the effect of the injections. Convulsions are to be treated by the local measures which are appropriate when they occur under other circumstances. At first no external treatment is required over the seat of the invagination, but when the abdomen becomes tender and painful from the local peritonitis, poultices are of service.

SECTION IV.

ZYMOTIC DISEASES.

CHAPTER I.

DIPHTHERIA.

THE term diphtheria, or diphtheritis, is applied to a blood disease, which, like measles or scarlet fever, has a local inflammatory manifestation. The inflammation occurs on mucous surfaces, and the skin when denuded of its epidermis, and is attended by fibrinous exudation. Diphtheria has of late years attracted much attention on the part of physicians as well as the public, on account of its epidemic visitation in many different localities, and the great mortality which has uniformly attended it. It has, during the last ten years, been the subject of frequent discussions in the medical societies of Europe and this country, and the journals during this period contain numerous reports of cases, and many monographs designed to elucidate its nature. Though there is much that is still obscure in reference to diphtheria, the great interest which it has awakened, has led to a better understanding of its nature, and a more judicious use of therapeutic agents.

Diphtheria presents itself under two forms, primary and secondary. The primary is more common. The secondary is usually a complication, or a sequel of scarlet fever or measles, or more rarely of typhoid fever, and this form is, therefore, chiefly observed when these diseases are epidemic. The two forms are identical in nature, symptoms, and appearance; the difference consisting in the fact that diphtheria, when occurring as a complication or sequel, is more serious and apt to be fatal. Ordinarily this secondary form commences before the primary affection abates,

so that there is no intermission between the two pathological states. The fevers which we have mentioned probably predispose to diphtheria, not only from the affinity which exists between them and that disease in consequence of their zymotic nature, but from the fact that diphtheria is more apt to occur if there is pre-existing faucial inflammation. In both measles and scarlet fever the pharyngitis is still present, and in many has not begun to decline when the diphtheria commences. For example, in a case of measles in my practice, death resulted from diphtheria, eight days after the commencement of the rubesculous eruption, the pseudo-membrane being first observed while the rash was still present.

ANATOMICAL CHARACTERS.—Before considering the anatomical changes which occur in diphtheria, it is well to state what cases I consider to be diphtheritic. When this disease is prevailing, most observers have remarked the frequent occurrence of pharyngitis without the pseudo-membrane; and some hold that these cases, as they seem to be due to the epidemic influence, should be called diphtheritic. But this would only lead to confusion. We might with equal propriety consider the sore-throat, which many physicians experience when attending cases of scarlet fever, as that disease. The term diphtheria should be limited to those cases in which the pharyngitis or other mucous inflammation is attended by the formation of points or patches of lymph, for it is only by the presence of lymph that we are enabled to distinguish diphtheria from simple inflammation, the constitutional from the local disease. By employing the term diphtheria with great latitude some observers have rendered the statistics of this disease, which they have published, almost useless.

The first departure from the state of health doubtless occurs in the blood, but the exact changes which this fluid undergoes, as in other zymotic diseases, have not been fully ascertained. I shall hereafter describe the appearance of the blood, as ascertained at the autopsies of those who have died of this disease. Immediately upon the invasion of diphtheria, redness is observed on some part of the faucial mucous membrane, usually that part covering a tonsil or in its immediate vicinity. The inflammation thus commencing as a faint blush, rapidly extends. The color of the inflamed surface is sometimes deep, bright red, almost like arterial blood; in others, it is dusky red, which indicates a vitiated state of the blood, and is an unfavorable prognostic sign.

The dusky-red appearance is most common in the secondary form. In a large proportion of cases, in the course of a few hours almost the entire buccal surface is involved in the inflammatory process. The mucous membrane of this part is thickened and softened, its follicles tumid and actively secreting, and there is more or less submucous infiltration. The intensity as well as the extent of the phlegmasia varies, however, considerably in different patients. In mild attacks it is often limited to a part of the fauces, and in these cases there are few exceptions to the rule that the uvular portion is affected, the redness gradually fading away in the healthy membrane beyond. There is swelling of the tonsils themselves, so that often they nearly touch each other. If the pharyngitis is general, the passage through this portion of the digestive tube is greatly diminished. The swelling of the inflamed surface is, however, *not* more, and in many children not so much, as in severe cases of simple pharyngitis.

Within a day and usually within a few hours from the commencement of the inflammation, a small semi-transparent, and almost diffuent point is observed upon the part most inflamed, or a thin film of little importance did the disease stop here, but very significant as a diagnostic sign, and as a forerunner of what is to happen. This substance, which is fibrinous, gradually becomes firmer, and at the same time thicker and broader, presenting a grayish or a grayish-white color. Sometimes different points or patches are observed, which extend and coalesce so that the fauces are almost entirely concealed from view. The pseudo-membrane is closely attached to the mucous surface. Entering the depressions and follicular orifices in its liquid state, it hardens like a mould, and is not easily detached. Attempts to separate it often lacerate the engorged capillaries, producing a free flow of blood. It does not ordinarily attain a greater thickness than one-eighth to one-sixth of an inch. I have seen it, however, not far from one-third of an inch thick.

The same pseudo-membrane is often firmer in one part than another, the outer and central portions being more compact and tough for a time than that underneath, which is more recent, and in which there is less fibrillation. After a few days, however, decomposition commences, and then that which was first formed, becomes softer than the more recent production. When this occurs, the color of the exudation changes from a whitish or a

grayish-white to a dirty brown, and its exposed surface is uneven, and jagged from the partial separation of shreds and fibres.

The escape of the liquor sanguinis from the engorged vessels diminishes somewhat the turgescence of the inflamed tissue. If this is considerable, the pseudo-membrane often sinks below the level of the surrounding surface, producing an appearance very much like that of an ulcer, or even of gangrene. Loss of substance in the mucous membrane is, however, rare; it unquestionably does sometimes occur. Excoriations or slight ulcers have been now and then observed at post-mortem examinations. Sometimes the pseudo-membrane has a reddish tinge. This is due to rupture of the capillaries, and the escape of the blood disks. It occurs in those cases in which the inflammation is intense, and the capillaries are greatly engorged. Sometimes we see the lower part of the exudation blood-stained, while the exposed surface has the usual grayish-white hue.

During the height of the inflammation it is astonishing often to see with what rapidity the diphtheritic membrane returns, when removed by force. A few hours often suffice to restore it as firm and extensive as before the interference. If the exudation is examined with the microscope as soon as it appears upon the lincial surface, it is seen to consist largely of cells, to wit, plastic nuclei and pus cells mixed with epithelia; with these elements, we find amorphous matter, and coarsely delicate interlacing fibrille. Subsequently fibrillation is more complete, rendering the false membrane more firm and resisting. In feeble children fibrillation is sometimes lacking, or is so slight as not to be observed with the microscope. In these cases, the pseudo-membrane is quite pulpy and friable, and is easily detached. Such was its microscopic character in a case which I examined in the Nursery and Child's Hospital of this city; the inflammatory product in this patient covered the mucous membrane of the stomach, as well as those parts which are commonly the seat of it. This case I shall allude to again.

By the microscope we are able to detect, in some instances, a conchyloid growth in or upon the pseudo-membrane. This is commonly the *oidium albicans*, or a plant closely allied to it, or the *leptothrix buccalis*, and its presence has led some observers to think that the primary and essential part of the adventitious

formation is parasitic. Fortunately, so erroneous an idea of the pathology of diphtheria is easily disproved, for in most cases of this disease, no vegetable growth can be detected. The pseudo-membrane does, however, constitute a favorable abode for the growth of confervæ, like any animal matter of low vitality, or of no vitality, and hence the cause of their appearance upon the fauces in this disease. Confervæ sometimes also grow upon the inflamed surface in simple pharyngitis producing an appearance which simulates closely that of the diphtheritic membrane, so that there is danger of mistaking the simple inflammation for the pseudo-membranous. As an example of the simple inflammation simulating the pseudo-membranous, may be mentioned the case of a little girl in this city, whom I was called to attend when diphtheria was prevailing. There was in this patient intense faucial inflammation with a grayish-white substance like lymph over one tonsil. This substance examined with the microscope was found to consist of the *lypethrix luvialis*, with epithelia and amorphous matter. The disease, which was speedily cured, would without microscopic examination have passed for diphtheria.

In favorable cases the pseudo-membrane is detached in a few days, and is either expectorated or swallowed with the ingesta. Its separation is promoted by the secretions underneath, especially by pus, which is formed in abundance between it and the surface on which it lies. In many, perhaps, a majority of cases, however, it does not separate in mass, but by progressive liquefaction. A little less of the pseudo-membrane is observed at each visit, until it entirely disappears. Such are the appearance, character, and history of the pseudo-membrane in this disease. Its common seat is upon the fauces, and in mild cases it is ordinarily found there alone. Unfortunately, the nature of diphtheria as a blood disease renders all the mucous surfaces liable to be attacked by the inflammation, and therefore in severe cases, and even in cases of moderate severity, we often find this product elsewhere, as well as upon the fauces, and in localities where, from its mechanical effect, it greatly increases the danger, and even compromises life. The mucous membrane of the nostrils, mouth, larynx, trachea, œsophagus, stomach, conjunctiva, vagina, and even the delicate lining of the external ear, are at times the seat of diphtheritic inflammation, with the characteristic product. If

the exudation occurs in the larynx, or air-passages below the larynx, we have the phenomena and result of true group. If upon a surface concerned in the digestive process, this function is more or less interfered with. I have already alluded to a case, which occurred in the Nursery and Child's Hospital of this city, in which patient the surface of the stomach was almost completely lined with the diphtheritic formation, so that the function of this organ was apparently nearly, or quite abolished. The occurrence of the pseudo-membrane in the nares is common, and is attended by the discharge of thin mucus and pus; but though inconvenient to the patient, its presence in this situation is not dangerous, except in the nursing infant, in whom it interferes more or less with lactation. The thin irritating discharge produces excoriation around the nostrils, and upon the upper lip.

Diphtheria is ordinarily attended by inflammation of the cervical glands, which lie in the cellular tissue behind and below the angle of the lower jaw, and in severe cases the cellular tissue is also involved, becoming swollen and indurated. The adenitis begins early, and corresponds in degree with the pharyngeal inflammation. It is never or very seldom as great in simple pharyngitis as in this disease. Great external swelling of the neck, indicating a grave form of diphtheria, is, therefore, to be regarded as an unfavorable sign. The inflamed glands and cellular tissue are hard and tender on pressure, but they less frequently suppurate than when similarly affected in scarlet fever. I have known but two instances of suppuration, the pus in both escaping externally through the skin.

The exudation occurs also on the cutaneous surface when blistered or abraded, and upon the edges of the wound produced by tracheotomy. This fact is interesting, as showing the pervading character of the diphtheritic virus.

Bronchitis is often present in diphtheria, with or without fibrinous exudation in the tubes. Pneumonia is also so often present that its occurrence is something more than mere coincidence.

In those who have died of diphtheria the blood has been found of a dark-red color, sometimes almost brown. Its appearance has been compared on account of its color to prune juice. This color is due, partly, in those who have died from asphyxia in consequence of exudation in the larynx, to imperfect oxygenation of the blood,

but it is also due to the malignant nature of the disease, as in the worst forms of scarlet and typhus fevers. The heart-clots are dark and soft.

Apart from inflammation of the tonsils and cervical glands, the glandular organs are not changed in their anatomical character so far as ascertained, with the exception of the kidneys. The state of the kidneys, and character of the urine will be described hereafter.

SYMPTOMS.—As with other zymotic diseases, the symptoms vary greatly in intensity in different cases. In general, in the commencement of an epidemic, diphtheria is more severe and fatal and its symptoms more violent, than when the epidemic influence is abating. The prominent symptoms are, however, often disproportionate to the gravity of the attack. Striking examples of this fact might be given from cases in my practice, the friends not supposing that there was any serious ailment, and not seeking medical advice till the fatal termination had nearly arrived. Diphtheria corresponds, in this respect, with all those affections in which the blood is profoundly altered.

The invasion of this disease may be gradual. There is a degree of chilliness, with rigors, often slight, succeeded by more or less fever, headache, languor, and loss of appetite. Still, the patient, if old enough, continues to walk about as if affected with slight and temporary ailment. The symptoms are like those of a cold, for which, indeed, the initial stage of diphtheria is often mistaken. With many one of the first symptoms is slight tenderness, or a sensation of fulness in the fauces. A distinguished clergyman of the Pacific coast, who fell a victim to this disease, dreamed a few nights before he complained of illness that his throat was cut. Doubtless the diphtheritic inflammation had already commenced, so that what seemed a foreboding had a natural explanation. So insidious was the commencement, in this case, that the disease had advanced beyond all hope of relief when medical advice was first sought.

In other cases the invasion is more abrupt and severe. Great febrile reaction, headache, pain in the ear, aching of the limbs, and loss of strength, compel the patient to take to bed from the first. Delirium may be present, but it is unusual.

The symptoms of invasion have but little prognostic value. I have met cases with a severe commencement, attended by deli-

rium, which terminated in complete restoration to health in less than a week, the presence of the membrane upon the fauces, and the occurrence of diphtheria in other members of the family, rendering the diagnosis certain. On the other hand, the milder commencement frequently takes in a fatal form of the disease.

The slight soreness of the throat or sensation of fulness, which accompanies the initial stage of diphtheria, does not ordinarily become any more severe during the course of the attack, and it often disappears within a few days. The pain on swallowing, and the tenderness, when pressure is made upon the throat, are usually less than in quinsy or simple pharyngitis. The absence or mildness of local symptoms is the main reason why the disease is so often overlooked in its first stages. I have known more than once, in consequence of the slight tenderness in the throat, the large external swelling to be mistaken for that of mumps, till an incurable stage of the affection was reached. I was once asked to see a little girl about ten years old, on account of this external swelling, which was limited to one side, and the character of which the parents did not understand. A physician visiting near by a few days previously, had been asked to see this patient, and without examining the fauces, attributed the swelling to inflammation of the root of a tooth, and had not thought it necessary to repeat his visit. This child, now within three or four days of her death, was walking about, not complaining of her throat, but with poor appetite, and with the pale cachectic aspect so common in advanced diphtheria, and having severe inflammation of the fauces, with a thick and firm pseudo-membrane extending from the pharynx forward to the arch of the mouth. The absence of subjective symptoms was strikingly shown in another case which came to my notice. A little girl had been ailing a few days, and had the external cervical swelling, but continued about the house and amused herself with playthings, even jumping the rope a few times on the day of her death. Finally, she sank rapidly of exhaustion, dying before a physician could arrive. These sudden and unexpected deaths in diphtheria are due to the profoundly altered state of the blood. If the inflammation invades the larynx, then the symptoms are immediately conspicuous and alarming.

The tongue in diphtheria is covered with a moist fur; sometimes more or less of the exudation appears upon it; the appetite

is poor; bowels regular. The pulse in different cases varies greatly in volume and frequency. It is often full and strong in the first days of the disease, but in the latter part, when death from asthenia approaches it is feeble and frequent. At first there are no marked symptoms referable to the respiratory apparatus. There is only that degree of acceleration of respiration, which corresponds with the amount of fever. In many cases, favorable as well as unfavorable, there is no cough and no embarrassment of respiration throughout the entire sickness, but when the inflammation affects the larynx, the respiratory symptoms are immediately conspicuous and alarming. Ordinarily in the infant, in the course of a few days from the inception of the disease, the swelling of the nasal mucous membrane, and the occurrence of exudation upon it produce snuffling respiration. The occurrence of the phlegmasia upon the laryngo-tracheal surface is indicated by hoarseness of the voice, and an occasional dry cough, and as the inflammation extends and the pseudo-membrane forms, the cough becomes more frequent, and harsh or raucous, as in true croup. Indeed, the anatomical character, as regards the larynx and trachea in diphtheria, when they are the seat of fibrinous exudation, is identical with that of croup. As the inflammation in the larynx and trachea, when accompanied by fibrinous exudation, is rarely amenable to treatment, the symptoms of obstructed respiration become more continuous and severe as the disease advances, till finally the dyspnea is extreme; the inspiration is protracted and whistling, and accompanied by great depression of the ribs; the countenance is anxious and pallid; the eyelids and fingers livid, and the little patient in vain seeks for relief by change of position. Occasionally, by great effort on the part of the child, or by fortunate treatment, a portion of the pseudo-membrane is expectorated, and for some hours there is apparently great improvement, but it is only in exceptional cases that the plastic formation is not speedily and fully reproduced. As death draws near the cough diminishes both in frequency and force.

The breath in malignant cases is not unfrequently offensive, having a gangrenous odor. There is in malignant cases intense pharyngitis, with a pseudo-membrane, which from its low vitality rapidly undergoes decay, and, also, in such cases great external swelling from the adenitis and cellulitis.

An efflorescence is sometimes observed upon the surface during the period when the temperature of the skin is exalted. This rash does not differ from ordinary erythema so common in the febrile and inflammatory affections of infancy and early childhood. It is not attended by the minute papule, which prologue roughness of the surface in scarlet fever. It is the erythema fugax of dermatologists suddenly appearing, and after some hours as suddenly disappearing. In many patients it is absent, and it is seldom if ever observed, except in the first days, when there is an active circulation.

The symptoms pertaining to the nervous system, which are ordinarily most prominent, I have already described. I have described the cephalalgia and muscular pains, which are present in the initial period, but they soon abate. Convulsions may occur in young children, but not oftener than in other diseases, attended by febrile reaction.

The heat of surface is in most cases less than in scarlet fever; it abates in a few days, and in advanced stages of the disease the temperature is natural or less than natural. The abdominal organs are seldom much affected in diphtheria, so far as ascertained, with the exception of the kidneys. There have not been many chemical examinations of the urine in this disease, but in a few which have been made (Sanderson, *British and Foreign Medical Chir. Rev.*, January, 1860) the quantity of urea excreted daily, was found to be considerably more than when convalescence had commenced. The most interesting and important change, however, in the constitution of the urine is the occurrence of albumen in it. This element was first discovered by Mr. Wade, of Birmingham, in 1857, and since then various observations in different epidemics and localities establish the fact, that albuminuria occurs in the majority of cases of severe diphtheria, and in many of a mild form. It often occurs at an early period, but in other patients it does not appear till the close of the first week, or commencement of the second. It continues three or four days to as many weeks, when in favorable cases it gradually becomes less, and soon disappears. While albuminuria is more common in diphtheria than in scarlet fever, the quantity of albumen in the urine is ordinarily less than in that disease. The albuminuria of diphtheria is further distinguished from that of scarlet fever in the fact already stated, that it occurs in the mild

of the disease ordinarily, and is attended by slight anasarca, often by none, whereas in scarlet fever it occurs after the subsidence of the fever, is attended by greater anasarca, and even serous effusion in the cavities. If we examine the albuminous urine of diphtheria with the microscope, we find in it filamentous casts and altered renal epithelial cells. These cells are opaque or granular, mainly from the deposit of fatty particles in their interior. But this appearance of the cells is not peculiar to the albuminuria of diphtheria.

Albuminuria in diphtheritic patients is, in the present state of our knowledge, rather a matter of scientific interest than of practical importance. It does not seem to be an unfavorable prognostic sign, and in most cases it requires no special treatment. Occasionally there is a considerable amount of albumen in the urine in cases which are not severe, and the quantity in the same patient may vary from day to day. In some grave cases of diphtheria the urine is scanty, and there is then danger of uræmic poisoning. If there is great and continued deficiency, death may occur from this cause in convulsions and coma.

The course of diphtheria, like the intensity of its symptoms, varies greatly in different cases, whether the result be favorable or unfavorable. Complete recovery may occur within a few days, less indeed than a week, but in other and perhaps a majority of favorable cases, weeks elapse before the health is completely restored. When the disease is so protracted the pseudo-membrane is detached slowly, or being detached, it is reproduced again and again. In these lingering cases, the countenance loses the appearance of marked cachexia, the appetite remains poor or capricious, the features are pallid, the body more or less wasted, and the strength reduced. Convalescence of such patients is slow and protracted, even after the inflammation has entirely disappeared.

The course of diphtheria lacks uniformity in fatal not less than in favorable cases. I have known death to occur in a robust child of two years and three months on the fourth day, without cough and entirely from the malignant nature of the affection. The strength was overpowered, and life so suddenly extinguished by the intensity of the diphtheritic virus. In this case there was great external swelling and intense pharyngitis. In other cases, as has been previously stated, death occurs from diphthe-

ritic croup. * In other, and a large proportion of fatal cases, the disease is more protracted. Without embarrassment of respiration, and often apparently with but moderate inflammation, the patient gradually loses flesh and strength. The face presents a pallid and cachectic aspect, and sometimes there is a general flabby or oedematous appearance; the appetite is poor, and is improved but little by tonics; the pulse is accelerated, and is day by day more feeble, till, finally, death occurs from asæmia. In these lingering and dubious cases, all hope of recovery is sometimes dissipated by the occurrence of abundant hæmorrhage from the throat, in consequence of detachment of the pseudo-membrane and consequent rupture of the capillaries, or possibly sometimes from ulcers in the throat. I was once treating a little girl about nine years old with diphtheria accompanied by pretty severe pharyngitis, and she had entered the third week, with prospect of a favorable issue of the disease, when she was suddenly seized with profuse hæmorrhage from the fauces, which was repeated, and death occurred in forty-eight hours. So unexpected a result was apparently due to separation of the false membrane.

NATURE.—Though the inflammatory lesions in diphtheria are so severe and dangerous, they sustain a secondary relation to the disease itself. Diphtheria must be placed in the same category with smallpox, scarlet fever, measles, and other zymotic affections. Like them it is due to a specific virus. These diseases, though dissimilar in nature and appearance, are controlled by the same general laws, so that they are very similar as regards the mode of their occurrence. That there is a miasm generated in the persons of those affected and which propagates the disease is shown by numerous observations. The infectious nature of diphtheria is, however, doubted by some, though admitted by most pathologists. Facts such as those which prove the communicability of scarlet fever and measles, have been repeatedly observed in reference to diphtheria. Diphtheria, if it enters a family of children during its epidemic prevalence, usually attacks more than one. It attacks those who remain in the same room with a diphtheritic patient, while those staying in separate apartments escape. In the late epidemic of diphtheria in this city, I was asked to see a boy about ten years old with diphtheria. The father had left home a few days previously, and escaped the disease. A servant girl, who was much frightened and remained in

a distant part of the house, also escaped. Three sisters, who were daily exposed to the boy, took the disease within the ensuing week in a mild form. All had the pseudo-membrane, though of limited extent. Such facts, and there are many of a similar nature contained in the literature of diphtheria, establish the doctrine of the communicability of this disease as securely as almost any doctrine in pathology.

It is not known certainly whether diphtheria is inoculable, but it is believed by many that the saliva and pseudo-membrane of a diphtheritic patient applied to the abraded cutaneous surface or to the mucous membrane may communicate the disease. The illustrious Valleix, whose writings hold so conspicuous a place in the literature of children's diseases, was attending a child with diphtheria. One day, on examining the throat of his patient, he received in his mouth a little of the saliva, ejected in the effort of coughing. The next day a small concretion appeared on one tonsil. The inflammation and the pseudo-membrane extended, and in forty-eight hours Valleix died, though his patient recovered. This case and others similar to it, which have been published, do not prove the inoculability of diphtheria, for the same result might have occurred in the ordinary mode in which contagious diseases are transmitted, namely, by infection. But as all who have seen much of diphtheria from the time of Bretonneau have now and then observed cases like that of Valleix, it is certainly the part of prudence, till the question of inoculability is settled to avoid all needless exposure. Bretonneau believed not only in the inoculability, but that this is the only way in which diphtheria is communicated.

Diphtheria, also, like typhus fever, often occurs without exposure. Whenever it visits a region it commences in localities remote from each other, some of which are so secluded as to negative the idea of importation. For example, in this country as well as in Great Britain, during the recent epidemic, it prevailed in remote farming sections as early and sometimes earlier than in the commercial centres. Children who had lived for months secluded in farm-houses were sometimes the first to be affected.

Infectious diseases have a period of incubation. Observations show that this is short in diphtheria, though, as in scarlet fever, it seems to vary in different cases. This period is usually from two to seven days.

Diphtheria, whatever the local manifestations, is always essentially the same disease. A mild may communicate a severe form, and vice versa, and cases, which at first view might appear to be different on account of difference in the seat of the phlegmonia, are shown to be identical in nature by occurring together, and in consequence of the same exposure.

Allusions have already been made to the epidemic character of diphtheria. Sporadic cases occasionally occur. The epidemic form is more severe and fatal than the sporadic. The history of the various epidemics shows the universality of the specific virus, for diphtheria has prevailed in all seasons, in all or nearly all climates, in the rural districts, remote, and sparsely settled, as well as in the cities, and in mountainous regions, as well as in valleys. It is, however, most prevalent and fatal where anti-hygienic conditions prevail, as in the tenement-houses of the city, and especially in such apartments as are dark and damp, but which necessity compels the poor to occupy. A large proportion of the severe cases seen by myself, during the recent epidemic in New York, occurred in the upper part of the city along the old water-course, where in consequence of grading of the streets there was more or less stagnant water, which was impregnated with decaying animal and vegetable matter. In these localities even where the population was sparse some of the first as well as last cases occurred, and a large portion of those affected died.

Diphtheria occurs at any age. I have known the infant of three months die of it, and many adults fall victims when it prevails as an epidemic. Much the largest number of cases, however, occur between the ages of two years and eight or ten. The occurrence of this disease at so early an age as three months, and on the other hand, in adult life, affords one point of contrast between diphtheria and scarlet fever, as well as true croup, both which rarely occur at so early and so advanced an age.

SyMPTOMs.—Those who recover from a severe attack of diphtheria, remain often for weeks with a pale and cachectic appearance. The blood is evidently profoundly altered, so that there is a deficiency of blood disks or a state of *spanemia*, which slowly disappears. This is a common result of protracted constitutional diseases, but it is more noticeable after this than most kindred affections. The excretion of albumen from the kidneys no doubt increases materially the impoverishment of the blood.

There is another sequel, which possesses great interest, as it is peculiar to diphtheria, and as its etiology is not fully understood. This sequel is paralysis. Paralysis does not occur till after the abatement of the inflammatory symptoms. The patient seems fully convalescent. The fever has ceased; the appetite is returning; the siccula is becoming less, and there is prospect of speedy restoration to health when this nervous affection is developed. The interval between the subsidence of the inflammation and the commencement of the paralysis is usually two or three weeks. The muscles most frequently affected are those of the pharynx, so that deglutition is rendered difficult, to such a degree often, that nutrition is seriously interfered with. The aliment taken passes back through the nostrils, or is not swallowed till after several successive efforts. In the attempt to swallow a portion of the food sometimes enters the larynx, so as to produce violent coughing. As we observe the dysphagia, it seems as if there must be pharyngitis, which renders deglutition difficult, but on inspecting the fauces we find no evidences of inflammation. The mucous membrane has recovered its normal appearance, and the nerves only are affected. The *volum palati* hangs flaccid and motionless, like a curtain. In some there is only pharyngeal paralysis, but in many this nervous affection occurs in other parts. Whenever it occurs elsewhere the pharyngeal muscles are nearly always involved at the same time. Diphtheritic paralysis may affect the motor muscles of the eye, causing strabismus, the muscles of one side causing hemiplegia, of the legs causing paraplegia, or of an arm on one side and leg on the opposite. It does not commence simultaneously in the various muscles which are affected, but in succession, those first affected being for the most part the muscles of the pharynx. In some the muscles of the bladder have been paralyzed, leading to retention of urine or difficulty in passing it. Paralysis in the limbs is frequently preceded by tingling or a sensation of formication. There is often not a total loss of sensation or of motion in the paralyzed part, but there is numbness with great difficulty rather than impossibility of motion. A few cases have been reported in which the paralysis was almost general, and some believe that they have met cases in which the heart was paralyzed, death occurring suddenly and unexpectedly. Dr. J. B. Reynolds relates a case in the *New York Journ. of Med.* May, 1869, in which there was not only strabismus, partial paralysis

of the limbs, and paralysis of the muscles of the pharynx, so that food was regurgitated, but the head dropped forward so that the chin rested on the sternum.

A majority of those affected with paralysis recover, although few regain the complete use of their muscles in less than one month, and many do not till between two and four months.

Defect of vision is an occasional result of diphtheria; some have presbyopia; others myopia; some see double; some are anisotropic, while in others one pupil is more dilated than the other, or both pupils are dilated, and feebly sensitive to light. This impairment or perversion of vision gradually disappears as the vigor of system returns.

Prognosis.—The prognosis in diphtheria is more favorable when it occurs sporadically, or at the close of an epidemic, than when the epidemic influence is prevailing. Though a constitutional disease, its gravity is in a majority of cases proportionate to the local symptoms. Therefore, intense pharyngitis, an extensive pseudo-membrane, and great cervical cellulitis and adenitis, indicate a form of the disease, which usually proves fatal in the robust, as well as weakly. When the inflammation extends to the larynx, and the phenomena of croup arise, there is slight prospect of recovery. There is then present the anatomical character of true croup, in addition to the depressing influence of the diphtheritic virus. The local disease, apart from the constitutional, we know to be ordinarily fatal. Much more unfavorable than is the prognosis, if the two are combined. When the croupy cough, voice, and respiration are observed, he will seldom err, who predicts a fatal result within a week, and often death follows in two or three days.

Great acceleration of the pulse continuing after the first week, a countenance pallid, with softness or flabbiness of the tissues, the occurrence of hemorrhage from the fauces, or other parts, are prognostic of an unfavorable ending. The secondary form of diphtheria is more apt to prove fatal than the primary, in consequence of the depressing effect of the antecedent disease.

From what has already been stated, it is obviously injudicious to predict a favorable or an unfavorable termination, from the character of the initial symptoms, since an obstinate and fatal case often commences mildly, and cases easily managed may commence with violent symptoms. But if the inflammation, mucus,

and glandular, remain of a mild grade, if the pulse is not greatly accelerated, if the constitution is good, and there are no laryngeal symptoms, a good result is highly probable.

In many cases after the active symptoms have somewhat abated, the result for days or even weeks is uncertain on account of the anemia. A majority, however, who have passed through diphtheria, recover, even if there is great impoverishment of the blood, provided that there are no serious local symptoms. Diphtheritic paralysis which is so alarming to friends, may continue several months, but it is very seldom permanent, perhaps never. Only in exceptional instances do patients affected with it die. This result is probably due in general to imperfect nutrition, resulting directly from the diphtheria, or from the dysphagia, which is present in consequence of the paralysis.

DIAGNOSIS.—The liability of mistaking simple pharyngitis, when attended by the growth of *Coccæ*, for diphtheria has been already sufficiently pointed out. By the microscope the diagnosis in such cases is rendered easy. The greater amount of external swelling in pseudo-membranous pharyngitis is also a means of distinguishing this disease from the simple form. There is, in some cases, a close resemblance of diphtheria to scarlet fever, especially as regards the condition of the system generally, the pharyngitis, and the external glandular swelling. The rash upon the skin, and the absence of a pseudo-membrane upon the fauces, in scarlet fever, are usually sufficient to establish the diagnosis. In almost all cases of diphtheria, this pseudo-membrane can be seen on inspecting the fauces. The cases in which it is not visible, during the active period of the disease, are so few that no account need be taken of them. The superficial gangrenous state of the throat, occasionally present in scarlet fever, can be distinguished by careful examination from the pseudo-membranous pharyngitis of diphtheria. Occasionally anginous scarlet fever is attended by a fibrinous exudation, especially upon the tonsils, but the quantity is insignificant, unless, indeed, there is at the same time diphtheria. Practically, it matters little whether we make a differential diagnosis of scarlet fever, and diphtheria, as the two require very similar therapeutic measures.

Diphtheria, with the pseudo-membranous laryngitis and true croup, present great similarity as regards symptoms. One has often been mistaken for the other, to the great injury of the

patient, for the two diseases require different treatment. With proper care, however, in examination, with a knowledge of the history of the case, the character of the affection can generally be ascertained. The inflammation of croup begins with the larynx, and the pharynx, though generally inflamed, is inflamed secondarily, whereas the inflammation of diphtheria begins with the pharynx, the laryngitis occurring some days later. Therefore, in diphtheria there is usually the fever, with tenderness and tumefaction of the faucial surface, and fibrinous exudation, before the cough, or other symptoms of laryngitis occur. In croup the characteristic voice and cough are present from the first, and if we inspect the fauces in the commencement of the disease, we find only a degree of redness, and though at a later period, points or patches of pseudo-membrane may be observed, the inflammation of the pharynx remains less intense throughout the disease than that of the larynx, as shown by the symptoms. By attending to these particulars, a correct diagnosis of croup and diphtheria can ordinarily be made.

TREATMENT.—It has been proposed in the treatment of this and other zymotic affections to give medicines to prevent the supposed fermentative processes going on in the economy, and by this means to ameliorate, if not entirely control the morbid action. Prof. Polli, of Milan, has recommended for this purpose the use of the sulphites, in the belief that the sulphurous acid set free in the system by their decomposition, prevents, or tends to prevent, catalysis. Experiments have shown that this agent does check fermentation without the system, and the theory of Polli possesses a degree of plausibility. But in such matters the only reliable guide is experience. The doctrine of catalysis in disease is indeed merely, as yet, an hypothesis, having the appearance of correctness. If experience show that the sulphites are beneficial in the treatment of the so-called zymotic affections, we are then, and only then, justified in employing them. In our present imperfect knowledge of pathology, and of the action of medicines, theorizing should succeed observation. It is difficult to determine the exact value of any medicine in the treatment of zymotic diseases, since so many cases terminate favorably without medicines, but some of the physicians of this city who have used the sulphites speak favorably of their effect. My own experience with them has been limited. I have seen improvement in severe

scarlet fever when these agents were employed, but remained in doubt whether the same result would not have followed with the use of other measures. The most eligible of the sulphites is the bisulphite of soda, since this gives a large amount of sulphurous acid, has no purgative effect, like some of the sulphites, or other injurious action, and from its name insures against any mistake on the part of the druggist. The word sulphite has been mistaken in a prescription for sulphate, the error not being detected till the child was weakened by purgation. Bisulphite of soda is readily soluble in water as well as alcohol, and to a child of three to five years one to two drachms may be given in twenty-four hours in doses of five to ten grains.

B. — Soda bisulphit. $\mathfrak{z}\text{ij}$ — \mathfrak{ij} ;
Tinct. ariet. $\mathfrak{z}\text{ij}$;
Aque $\mathfrak{z}\text{x}$ — Mice.

Dose, one teaspoonful every two hours. Sometimes in place of water a limer infusion like that of quinine has been employed.

Death in diphtheria, as we have seen, ordinarily occurs from exhaustion or from obstructed respiration. Knowledge of this fact aids in the choice of therapeutic measures. Diphtheria is decidedly an æsthenic disease; therefore sustaining treatment is required. From the first, although the pulse is strong, the surface hot, and features flushed, all measures of a depressing nature must be carefully avoided. Great febrile excitement, in connection with robustness of system, may incline us to the use of cardiac sedatives, but they should not be administered, or if administered, only the mildest should be given and with caution, since diphtheria, if it continue a few days, is attended by evident symptoms of prostration, whatever the mode of commencement. Nutritious food, like the animal broths, should be given often and in a concentrated form, on account of the difficulty of swallowing, and recourse should be had to alcoholic stimulants, as wine whey or milk-punch, as soon as there are any indications of feebleness. An extensive pseudo-membrane and great glandular swelling show a form of the disease which requires immediate and active sustaining measures. The apartment occupied by the patient should be kept clean and dry, as indeed it should be in the treatment of any zymotic affection. A change of apartments during the day is also advisable, particularly in those cases in which there is a gangrenous odor.

As the sulphates have not been employed sufficiently long to determine their value, or whether, indeed, they have any effect in controlling diphtheria, it does not seem judicious until they are more fully tested, and are found to accomplish what is claimed for them on theoretical grounds, to discard in cases that are at all critical, those remedies, which appear to be indicated from the nature of the disease, and which have met the general approval of the profession. These remedies are the tonics, vegetable and ferruginous.

A large number of these medicinal agents might be mentioned, all of which would be likely to result in more or less benefit, but I will only mention such combinations as are well adapted to meet the various indications.

Chlorate of potash or soda, and tincture of the chloride of iron are the two remedies which have been most employed in this country and in Europe, on account of their supposed local effect on the inflamed surface, and the latter on account of its emulsi-
tous properties. Prescribed in combination, these medicines are not unpleasant to the taste, and I consider this mixture one of the very best for ordinary cases of diphtheria.

R.—Tinct. ferri chloridi 5j ;
Potas. chlorat. ʒi ;
Syr. simplif. ʒij.—Misc.

Dose, one teaspoonful every two or three hours in a child of three years.

I have usually given directions to allow no drinks to the patient for a few minutes after each dose, in order that the full local effect may be obtained. The tincture of the chloride of iron alone, the wine of iron, or any of the other ferruginous preparations may be advantageously administered, especially in nervous cases in place of the mixture mentioned above. In those of full habit and florid complexion, iron is not so imperatively required. In such cases the elixir of Calceaya bark, in doses of one teaspoonful to a tablespoonful, according to the age, is a useful, and not unpleasant remedy. The fluid extract of cinchona, or columbo, also meets the indication.

There is difference of opinion as regards the value of local treatment in diphtheria. Some hold that as it is a constitutional malady, and that as death in it is ordinarily due either to exhaustion or to inflammation of the larynx, which we cannot subject to any reliable local treatment, therefore, topical measures directed

to the throat, which worry and fatigue the child, are not advisable. But, as Trousseau has remarked, the gravity of diphtheria is usually proportionate to the amount of local disease, and if, therefore, we can moderate the intensity of the inflammation, we increase the chances of a favorable issue. The local disease reacts on and intensifies the constitutional, increasing the febrile movement, and exhausting the strength of the patient. Again, it is probable, though this opinion is not held by *some*, that the laryngitis of diphtheria often results from extension downward of the faucial inflammation.

For these reasons, direct treatment calculated to diminish the intensity of the faucial inflammation is proper, and yet those severe caustic applications, formerly much employed, and still used by some practitioners, by causing great pain and restlessness, weaken the child, and do more harm than good. Great gentleness on the part of the physician, in making applications to the throat, cannot be too strongly insisted on. Harshness towards a patient is always to be condemned, and in no disease more than in this. By gentleness and a little tact, much of the repugnance to the operation, on the part of friends, may be prevented.

The formulae recommended in the topical treatment of the larynx in croup are proper for the pharynx, as well as larynx in diphtheria. For these formulae the reader is referred to the article on croup. The tincture of the chloride of iron has been advantageously prescribed as a gargle with chlorate of potash in those old enough to employ such treatment. For this purpose a drachm of the tincture should be added to a table-spoonful of a saturated solution of chlorate of potash and gargled every hour or two. Simple demulcent or chlorinated gargles are often useful, the latter particularly, if there is decomposition of the pseudo-membrane and an offensive odor. The local treatment should, of course, vary according to the extent and character of the inflammation. When the pseudo-membrane is removed, and the inflammation has begun to abate, there is less need of active topical measures. They should soon be discontinued.

When croupy cough is observed in diphtheria it is well to administer, if the patient is robust, an emetic, which causes the least possible prostration. The sulphate of copper or of zinc is one of the best emetics of this class. At the same time general sustaining treatment is required. Quinine is given by many

practitioners, when croup supervenes, in sufficient quantity to reduce the frequency of the pulse. A child from three to five years old may take a grain every two hours. I know no better medicine for such cases, though unfortunately with this, or any other treatment, a large proportion die. Moisture in the apartment is desirable as in the treatment of true croup. If the laryngeal symptoms continue to increase, and the respiration becomes so embarrassed that lividity occurs, the propriety of tracheotomy becomes a serious consideration. It is only in exceptional cases that it saves life, but it renders death more easy.

If the patient have passed through diphtheria, and entered upon convalescence, attention should be given to his hygienic condition, and often therapeutic measures of a tonic character are still required. That most interesting and important of the sequelæ, namely, paralysis, gradually abates, without special treatment, as the tone of the system is restored. Strychnine may be given or the galvanic electric current employed as a means of expediting recovery. Prof. Metcalf, of this city, recommends the following formula:—

R.—Strychnine gr. j.
Acid. nitric. dilut. ℥j.
Aque ℥xvj.—Miste.

Dose, three to five drops in a dessert-spoonful of water three times daily to a child of three years.

The anæmic state which succeeds diphtheria requires the use of iron for several weeks.

CHAPTER II.

MEASLES.

THE disease known in our language as measles has also the names *rubeola* and *rubeoli*. It is a common exanthematic affection, occurring at any age, but most frequently in childhood. It affects once the majority of mankind. Writers recognize three stages of measles: first, that of invasion, which ends with the appearance of the eruption; secondly, the eruptive stage; and thirdly, the stage of decline or desquamation.

SYMPTOMS.—This disease commences with such symptoms as

usually occur in mild but pretty general inflammation of the air-passages, namely, cough, fever, anorexia, and thirst. The eyes present a suffused, moderately injected, and at the same time brilliant appearance, while the buccal and faucial surface is also injected. The Schneiderian membrane, and that lining the larynx, trachea, and bronchial tubes, participate in the increased vascularity. The cough at first is dry, and sometimes distinctly croupy. Catarrhal or false croup, indeed, is not infrequent in the initial period of measles. The cough is attended by little acceleration of respiration, and by little or no pain in the respiratory movements. If auscultation is practised at this early stage, we observe the vesicular murmur, somewhat harsh in character, and sometimes the sonorous, and sibilant rales. A little later, rales of a moist character appear.

The patient, if old enough, commonly complains of headache, and of dull pain in the epigastric region, or the centre of the sternum, due to the bronchitis. With these local symptoms febrile reaction occurs. The temperature rises to about 102° or 103° , as indicated by the thermometer in the axilla. The pulse numbers from 110 to 130 per minute. The fever is somewhat greater than in primary tracheo-bronchitis, in cases in which the latter is attended with so little embarrassment of respiration, but it is less than in most cases of scarlet fever.

The fever is the procatarrhical stage of measles after the first day is not uniform. It is attended by remissions and exacerbations, the former occurring in the first part of the day, the latter in the evening. Sometimes two exacerbations occur in the day. The face is flushed and somewhat swollen, especially during the times of increase in the fever, and the child is drowsy or restless. Vomiting, so common a symptom in the commencement of scarlet fever, occasionally occurs in measles. While in scarlet fever, this takes place in the first twenty-four hours, in measles it occurs with about equal frequency at any period previously to the eruption. It occurred during the first stage, sometimes almost as late as the eruptive period, in thirteen, and was absent in twenty-three cases, of which I have preserved records.

The duration of the first stage varies in different cases. It is usually from two to five days with an average of about four. Occasionally it is more protracted on account of some disturbance in the economy, either from exposure to cold or other cause, which prevents the necessary afflux of blood towards the surface,

and retards the eruption. In eighteen cases in my practice in which the duration of the cough previously to the appearance of rash was accurately ascertained, the time varied from one to five days, with an average of three and one-third; in ten other cases, it had continued, the parents stated, about a week, and in five, from one to two weeks previously to the eruption.

The eruption commences, when the disease pursues its normal course, upon the forehead and neck, then the face, and gradually extends downwards, occupying from twenty-four to thirty-six hours, in passing over the trunk and limbs. It appears first as indistinct red points, not more than a line in diameter, which increase in size, and become more distinct. Their borders are vagues or irregular, or they are finely notched; their general shape is, however, circular, except, as two or more unite, when they may assume any form. The crescentic form which writers describe is due to the union of two points of eruption. The largest of these spots, when there is no coalescence, do not exceed a quarter of an inch in diameter, and many are much smaller. Frequently in plethoric children, if there is much fever, there is continuous redness over several inches of surface. The eruption is then confluent. This form is often observed upon parts of the surface where the capillary circulation is most active, when it is discrete elsewhere. In some of these cases, diagnosis of measles from scarlet fever is attended with difficulty.

The rubescens eruption is slightly elevated. This is not appreciable to the sight, but can be ascertained by passing the finger slowly over the skin, when a little roughness is felt at the point of eruption. Sometimes the elevation, especially in the commencement of the eruption, is not appreciable, even to the touch. The eruption is broad and flat, never acuminate, never oblonging its form to the vesicular or pustular. It disappears by pressure, and immediately reappears when the pressure is removed. It has been compared in appearance to flea-bites. Small, pointed, papular, vesicular, or pustular eruptions are sometimes seen in connection with those of measles, but they are accidental, occurring in other states of system, as well as in measles, if there is the same augmented temperature.

In the commencement of the eruptive period, the severity of the constitutional and local symptoms increases. The pulse and temperature correspond with the character which they presented during

the exacerbations of the first stage. The features are slightly swollen; the eyes still watery and sensitive to light; the conjunctiva, ocular and palpebral, and the mucous membrane of the cavity of the mouth, and of the air passages continue injected. The tongue is covered with a moist thin fur, and its papillae are prominent, though less so than in scarlet fever. The cough continues frequent, and is seldom attended with much expectoration, in uncomplicated cases; often there is no expectoration whatever. There is thirst with anorexia. Diarrhoea sometimes occurs on the first day of the eruption, but it lasts only a few hours, and if the disease pursues its usual course, abates of itself. With the exception of this, the bowels are regular, or a little constipated during the eruptive period.

On the second day of the eruption, or sixth of the fever, the symptoms begin to abate. The pulse is less accelerated, and the temperature diminishes; the cough is less frequent, and is easier, and the flushed and swollen appearance of the face declines. By the close of the third or in the fourth day, the rash has disappeared in the order in which it extended over the body. There only remain faint maculae which, in the course of a day or two, fade completely.

With the disappearance of the rash, the fever nearly or quite ceases, but a slight and painless cough continues for several days.

Occasionally the eruption presents a livid appearance: this is the *rubeola nigra* of writers. From cases which I have observed, I believe that this should not be considered a distinct species in the vast majority of cases, but that the dark color is due to internal inflammation, usually capillary bronchitis or pneumonia, which prevents full oxygenation of the blood. Rarely *rubeola nigra* is due to the vitiated state of the blood, or the malignant nature of the disease. The course of the eruption in this form of measles is somewhat different; it continues longer, fades more slowly, and does not disappear so readily on pressure. Traces of it are observed a week or more after its first appearance; it is very apt to be fatal. Measles may present this form from the beginning, or commencing as vulgaris, it may pass into *rubeola nigra*.

Measles may be irregular in form, but aberrations are less frequent than in scarlet fever. Writers describe measles without catarrh, and, on the other hand, measles without the eruption. But positive diagnosis in such cases must be difficult. It is pro-

labile than simple catarrh and roseola have sometimes been mistaken for the two forms of irregularity mentioned. But when a child, in a family of children affected with measles, presents all the symptoms of that disease, except the catarrh or except the eruption, the diagnosis of irregular measles would, as a rule, be accurate.

Occasionally the stage of invasion is very short, or even absent. In one case, the parents informed me that the catarrhal symptoms began on the day when the eruption appeared. Convulsions sometimes occur at the commencement of measles, as well as during its progress. A single convulsive attack at the commencement of measles is usually not dangerous; when repeated, it is more serious; it is also more serious when it occurs in the course of measles. Sometimes the eruption appears, but in an irregular and partial manner. It appears, perhaps, at a late period and indistinctly upon the trunk alone, or upon the trunk, and partially upon the legs. In many cases of deferred or partial eruption, there is internal congestion or inflammation of some part which causes withdrawal of blood from the surface, and thus prevents the normal development of the rash.

When the eruption disappears, the third stage commences, that of desquamation. It is characterized by a scanty and furfuraceous exfoliation of the epidermis. The desquamation is seldom as great as in scarlet fever, and it occurs most where the eruption has been thickest, and the epidermis most inflamed. Exfoliation occurs between the fourth and seventh days after the commencement of the eruption, the eighth and eleventh of the disease. In some children it does not take place, or is so slight, as not to be observed.

With the disappearance of the rash, the symptoms rapidly abate. The pulse becomes more natural; the temperature is reduced; the digestive organs return to their normal state, and convalescence is established. The cough continues several days after the other symptoms abate, but it is less and less frequent, and is not painful.

COMPLICATIONS.—The complications of this disease are important. Much of the success of the physician in the management of measles, depends on a correct diagnosis, and understanding of them. The most frequent of these complications are bronchitis and broncho-pneumonia. Slight bronchitis is common

in measles, but if it increase so as to cause embarrassment of respiration and become a source of danger, it is properly a complication. This complication, as well as pneumonia, may occur at any period of measles, but it commences most frequently in the first stage. Occurring in the first stage, it may prevent the regular appearance of the rash; if, in the second, it often causes retrocession of it.

When bronchitis becomes really serious, it usually has invaded the minute bronchial tubes. This disease, designated capillary bronchitis or suffocative catarrh, I have elsewhere described. The clinical history of fatal bronchitis, as a complication of measles, is as follows: The respiration, at first not notably altered, becomes, by degrees, accelerated, and the patient more and more fretful. The pulse, instead of declining, as it does after the first few days of simple measles, is daily more rapid, and the respiration more frequent and labored. Dyspnoea increases each day, the infra-mammary region is depressed during each inspiration, and the subcrepitant rale is heard on both sides of the chest. There is, probably, collapse of some of the lobules. Finally the proboscis and fingers become livid, and death occurs from asphyxia. Capillary bronchitis is distinguished from pneumonia by the physical signs. It is in the young child more dangerous than that disease, unless perhaps the latter be double. A large majority of those affected, under the age of three years, die. The anatomical characters of fatal bronchitis occurring as a complication of measles, I have had an opportunity to inspect. In an infant who died with this complication in the Infants' Hospital in the spring of 1867, there were evidences of continuous inflammation from the epiglottis to the minutest bronchial tubes.

Pneumonia as a complication does not differ materially from the idiopathic form, except that it is somewhat more protracted and is more apt to prove fatal. It is apt to be associated with bronchitis, and the two affections are then designated bronchopneumonia.

The next most frequent serious complication of measles is entero-colitis. This may commence at any period during the course of the disease. If the colon is more especially the seat of inflammation the evacuations contain mucus and blood, unless in young children, in whom the stools, even in pretty severe colitis, are frequently green. The anatomical character of this complica-

tion varies in different cases like the idiopathic form of inflammation. Sometimes there is simple arborescence of the mucous membrane with tumefaction of the intestinal glands; in other cases, in addition to increased vascularity, the membrane is softened and thickened, and in others still, especially if the inflammatory action has been somewhat protracted, ulceration occurs for the most part in the site of the solitary glands. Exceptionally, in fatal cases of measles attended with diarrhoea, no vascularity is observed after death, although the membrane may be somewhat thickened and softened. In these cases the diarrhoea may have been non-inflammatory or inflammatory, the injection of the vessels having disappeared after death.

Severe and obstinate diarrhoeal affections occurring with measles, usually commence as the primary disease is about declining. They then become sequelæ, ending fatally in many instances several days or perhaps weeks after the disappearance of the eruption. Diarrhoeal attacks, occurring in, or previously to the eruptive stage, are as a rule mild and easily relieved.

In some grave cases measles have a tendency from the first to affect the internal organs more than the surface. There then exist bronchitis, pneumonia, and entero-colitis, with indistinctness of the eruption on the skin. Such complications render a fatal result highly probable.

Another very fatal complication or sequel is true croup. This commences when measles is beginning to decline; commences either in the second or third stage. In catarrhal or false croup, which, as has been previously stated, is not infrequent at the commencement of measles, the cough has a loud ringing character. In true croup, on the other hand, it is hoarse or harsh, and less distinct on account of the presence of the pseudo-membrane in the larynx. True croup, always a grave disease, is more serious when it occurs as a complication of measles, than in the idiopathic form, not only because the blood is vitiated, and the system relaxed by the primary affection, but because the inflammation of the mucous surface is in general more extensive, as is also, I believe, the pseudo-membrane. This membrane in the croup of measles, as I have seen it, extended so far down the air-passages, that tracheotomy could not have been attended by much amelioration of symptoms. This secondary form of croup is not always, however, extensive or fatal. I have known cases to recover by

ordinary treatment, when for days there had been dyspnea and other evidences of a pretty firm pseudo-membrane. True croup causes continuation of the fever, which had perhaps begun to abate.

Diphtheria when epidemic also frequently complicates measles. Much of the mortality from measles in this city between the years 1840 and 1845, was due to this cause. In cases observed by myself, diphtheria usually began while the fauces were still inflamed, and sometimes before the eruption had begun to fade.

These are the most common complications of measles. There are others of less frequent occurrence, among which may be mentioned congestion of the brain, with or without serous effusion. Stomatitis, pharyngitis, and otitis are occasional complications. Rarely, also, purpura, attended by hemorrhages from the different mucous surfaces, occurs in connection with measles. This complication is, however, more frequent in some of the other zymotic affections, as scarlet fever, and especially variola.

It is seen that the inflammations, which are apt to occur in the course of measles, are chiefly of the mucous surfaces. In scarlet fever, on the other hand, the inflammations are serous.

There are other affections, originating in measles, which are rather sequelæ than complications. Gangrene of the mouth is one which, as stated in another part of the work, is more apt to occur after measles than after any other disease. Ophthalmia commencing in measles sometimes persists for weeks or months. It may give rise to granulations of the lids, and rare cases have been reported of violent inflammation of a purulent character, producing ulceration of the cornea, and destroying vision. The ophthalmia is sometimes very intractable. Inflammation of the Schneiderian membrane, commonly present during measles, sometimes continues, extending back as far as the Eustachian tube, where it may cause swelling, with impairment of hearing, and forward to the lip, where it may produce chronic eczema.

ANATOMICAL CHARACTERS.—I have made, or witnessed according to remembrance, some five post-mortem examinations of those, who have died in, or immediately after an attack of measles. In all there were lesions due to complications. Indeed, death directly from measles, is so rare that few have had an opportunity of studying the anatomical characters, which are peculiar to this affection. In those who have died without any obvious coexisting disease, and these cases chiefly occur in the malignant form,

there has been congestion of the internal organs, especially marked in the lungs, and sometimes the thones appeared softened. The blood, also, in the malignant form, has a darker hue than natural, and ecchymotic patches have been observed upon the mucous surfaces and elsewhere, corresponding in character with the petechiæ under the skin, which sometimes occur in this form of measles. The bronchial glands are often more or less tumefied from inflammation, in those who have died of measles. This adenitis is due to the bronchial inflammation, in the same way as in enteritis, the mesenteric glands become inflamed, and in dysentery the glands of the meso-colon.

NATURE.—Rubéola, like the other exanthematic fevers, is due to a *materia morbi*, the exact nature of which is unknown. It is both inoculable and infectious. It has been inoculated by the serum, from vesicles, which sometimes occur in connection with the rubescens eruption, and also by the blood, from a patient. Inoculation does not appear to moderate the disease, and as measles, when contracted in the ordinary way, is not in itself dangerous, but dangerous only from complications, inoculation is not performed, except as a matter of scientific interest. The usual mode of propagation is by infection. It is communicated both by the breath and clothing. By fomites the virus is sometimes conveyed a long distance. The question is still undecided whether rubéola does not sometimes occur spontaneously. I have met cases, and have been informed of others, one especially, occurring in a sparsely settled portion of the country, in which there could apparently have been no exposure, and I incline to the opinion that its origin *à novo*, is possible, though not frequent.

The period of incubation of measles is usually from ten to fourteen days. In cases observed in the children's department of Charity Hospital, this period was ascertained to be about twelve days. In those who have been inoculated, the incubative period is said to have been about one week. Rubéola prevails epidemically like the whole class of zymotic diseases, and in different epidemics, the type varies somewhat as well as the character of the complications.

DIAGNOSIS.—The diagnosis of measles, previously to the eruption, is often difficult. The catarrhal symptoms then predominate and these are such as may occur, independently of any equilibri-

tional or blood disease. The first stage, therefore, of measles is often mistaken for coryza, or mild bronchitis. The points of differential diagnosis are the suffused appearance of the eyes, the greater degree of fever on the first day, than would be likely to arise from so moderate an amount of local disease, and on subsequent days, remittance of the fever. Measles in the first stage have been mistaken for remittent fever. The catarrhal symptoms should prevent such an error.

Sometimes roseola closely resembles measles in appearance, but the rash of roseola appears within a few hours after the commencement of febrile symptoms, and it occurs almost simultaneously over the whole body, and without those local symptoms referable to the mucous surfaces, which characterize measles.

Varicella on the first day of the eruption has sometimes been diagnosed as measles. I recollect once being called to an infant with fatal confluent smallpox, who was said to have measles. A physician, a few days previously, observing the red points in the commencement of the eruption, had made this absurd diagnosis, and, predicting a favorable result, had not thought it necessary to repeat his visit. In case of doubt, it is the part of prudence to defer making a positive diagnosis. A few hours suffice to show the distinctive characters of the rubellous and variolous eruptions. But the anxiety of friends often necessitates the expression of an opinion. The absence of catarrhal symptoms, the earlier appearance of the eruption, and its papular feel under the finger in smallpox, enable us to discriminate between the two diseases in the commencement of the eruptive stage. Moreover, the symptoms in the initial periods are different, as will be seen in our description of smallpox.

PROGNOSIS.—This is favorable, provided that there is no serious complication. With internal inflammatory complication, on the other hand, the disease becomes much more grave. A large proportion thus affected die. The prognosis is also less favorable in feeble children with scanty eruption, or an eruption appearing at a late period and irregularly. Dyspnoea, persistent and great acceleration of pulse, and coma indicate an unfavorable ending. Convulsions occur much more rarely in the course of measles than in scarlet fever, and when they occur after the initial period they usually end in coma and death.

TREATMENT.—Uncomplicated measles requires no medicinal

treatment except to palliate symptoms. The child should be kept in an airy apartment, at a uniform temperature of about 48°. A temperature so elevated as to be uncomfortable to the nurse is injurious to the patient. But while the popular idea is erroneous, that he should be kept in a heated atmosphere, it is correct that currents of air and sudden reduction of temperature are dangerous. A violent and fatal attack of croup occurred in my practice in a girl of fifteen, in consequence of exposure at an open window during the period of desquamation. The diet should be mild, and for the most part liquid. The patient, indeed, refuses solid food, but on account of the thirst takes liquids more readily. Farinaceous substances with milk afford sufficient nutriment in ordinary cases. If the previous health has been poor and the vital powers reduced, or if there is a complication, more sustaining diet is required. Stimulation by wine or brandy is needed in some of these cases. During the two or three weeks succeeding an attack of measles, care should be taken to avoid exposure to cold, or changes of temperature, since during this period measles inflammations are so apt to occur.

The cough in most cases requires treatment, inasmuch as the suffering of the child and loss of sleep are largely due to this symptom. Demulcent drinks, as flaxseed tea, infusion of slippery-elm bark, or solution of gum Arabic, are useful, to which, to render them more palatable, lemon juice may be added. A small Doser's powder, or the following mixture given occasionally, relieves the severity, and diminishes the frequency of the cough:—

B.—Tinct. opii camphorat.,
 Syr. acilla,
 Syr. specac., ℥ ss,
 Syce. ether. nit. ʒi.—Micc.

Dose, one teaspoonful to a child of five years, repeated according to circumstances.

As the chief danger in measles is from inflammation of the respiratory organs, local treatment directed to the chest is important. The chest should be covered with oil silk, unless in the mildest cases. This increases the amount of evaporation upon the surface underneath, and, I believe, tends greatly to prevent complication by bronchitis and pneumonia. If the eruption is early in its appearance, or indistinct, it is well to produce moderate

counter-irritation by some gentle irritant underneath, as cataplorated oil.

Affections, which complicate measles, should receive, for the most part, such treatment as is appropriate for them when idiopathic. Secondary diseases, however, require sustaining measures more than primary. In bronchial and pulmonary inflammations, which, if they occur early in measles, prevent the regular appearance of the eruption, or, if in the eruptive stage, cause its disappearance, prompt counter-irritation over the chest, by sinapisms or otherwise is required. Trousseau states that he has derived benefit, in these cases, from what he designates *artication*. This is produced by stroking the chest two or three times daily with the nettle (*urtica dioica* or *urtica urens*). This causes a prompt and abundant eruption, and with a less amount of suffering, than one would suppose. The fever abates, and the respiration becomes more natural in proportion to the amount of nettle-rash. On the second day, the effect is less than on the first, and after three or four days, says Trousseau, no farther irritation results from the nettle. When counter-irritation is produced by whatever method, the chest should be covered with a warm and soft poultice, as the ground flaxseed; derivatives to the extremities are useful in such cases. In capillary bronchitis and pneumonia stimulating expectorants are required, as *serena* and carbonate of ammonia.

As regards the treatment of other complications, the appropriate measures are detailed elsewhere.

CHAPTER III.

SCARLET FEVER.

THE terms scarlet fever, scarlet rash, and scarlatina are identical. They are employed to designate one of the most frequent and fatal of the zymotic diseases, a disease which may occur at any age, but is most common in childhood, an exanthem attended with more or less pharyngitis. In this city, on account of its great frequency, and its large percentage of fatal cases, it causes more deaths than any other contagious affection. Though not

more common than measles, it is attended, with us, by more than double its mortality.

There is no disease that presents a greater difference, as regards character and severity of symptoms, than scarlet fever, and this has led to the recognition of different forms of it. Billiet and Bartholin describe two, the normal and abnormal; Meigs two, the mild and grave; and most other writers, three or more. I shall, for convenience, follow Bouchat, who makes three varieties, namely, the regular, irregular, and malignant.

Symptoms. Regular Form.—Scarlet fever usually begins abruptly. It is possible, often, to tell the exact time of its commencement. If there are premonitory symptoms, they are ordinarily slight, so as scarcely to attract attention, amounting to little more than dulness, or the appearance of fatigue. In some the first symptom is chilliness, and occasionally a distinct chill is experienced. This is the ordinary mode of commencement in the adult. With or without the chilliness, fever, usually intense, arises, accompanied by such symptoms as ordinarily occur in a febrile state of system, such as cephalalgia, perhaps delirium, anorexia, thirst. The pulse rises to 110, 120, or more, per minute; the skin is hot, face flushed, the eyes bright, and occasionally more or less suffused. In many, there is sudden starting or twitching, with a degree of stupor, showing that the cerebro-spinal system is profoundly affected.

In most cases there occurs within the first twenty-four hours a symptom which has considerable diagnostic value, namely, vomiting. In 117 cases in which I have recorded its presence or absence, it occurred in 90, usually not at the very commencement, but within the first twelve or eighteen hours. It commonly occurred before the appearance of the rash, but not always. In a few of the cases it is recorded as a symptom of the second day. Vomiting at this period is, in my opinion, usually sympathetic, due to the effect of the specific virus of the disease on the brain. It is not a severe symptom, occurring, in most cases, but once or twice. Great and persistent irritability of stomach indicates a serious form of scarlet fever, and is, therefore, prognostic of an unfavorable ending. When this symptom is absent or slight, or there is merely nausea, I have found the case ordinarily mild, so that, as regards the frequency of vomiting, the statistics of different epidemics, doubtless, vary according to the mildness or

gravity of the type. The bowels are regular, or somewhat constipated in this form of scarlet fever, or, if diarrhoea occur, it is slight or transient.

When the symptoms described above have continued six to eighteen hours, the rash appears. It is first observed about the ears, neck, and shoulders in reddish indistinct patches, gradually fading off. These patches rapidly extend and unite, and in the course of a few hours, the trunk and upper extremities, and finally the legs are covered. The scarlatinous rash bears considerable resemblance to that produced by external heat or the redness from a sunburn, but there are numerous minute points of a deeper or dusker red, than the surface generally. On passing the finger over the eruption, no distinct prominences are observed, but a sensation of roughness is sometimes imparted from enlargement of the cutaneous papillae. The rash disappears by pressure, but in robust children, and in favorable cases, it immediately returns when the pressure is removed. Slow return of the rash is evidence of sluggish circulation, and, when marked, it indicates the malignant form of the disease. The rash gives rise to an itching or burning sensation, which adds greatly to the discomfort of the patient. The degree of redness is not uniform over the surface, and sometimes, especially in mild cases, it is absent in places.

Early in the disease, even before the cutaneous eruption, the buccal and faucial mucous membrane presents a pretty general red appearance, and the papillae of the tongue are elevated. Pharyngitis has already commenced with a degree of stomatitis and tonsillitis. The inflammation renders deglutition painful, so that difficulty is often experienced, in giving the necessary drinks. This state of the buccal and faucial membrane continues through the disease. There is sometimes a slight fibrinous excretion over the tonsils; the tongue is covered with a moist fur, and the secretion from the follicles of the inflamed surface is increased and mucopurulent. The Schneiderian membrane also participates more or less in the inflammation, and as the disease advances, a thin irritating discharge, containing pus cells, flows from the nostrils.

The temperature, in the first days of scarlet fever, is ordinarily from 102° to 103° , sometimes as high as 107° . The cutaneous transpiration during this period is nearly checked, so that the skin is hot and dry. The respiration is moderately accelerated, but not so as to attract attention, unless there is a congestion;

often there is slight cough from mucus in the throat, or bronchial tubes. Bronchitis, common in measles, and giving rise to prominent symptoms in that disease, is either absent, or slight in scarlet fever.

The symptoms pertaining to the digestive system during the initial period of scarlet fever have been sufficiently described. The subsequent symptoms do not differ materially in regular scarlet fever, except that there is no vomiting. The lips are dry and often cracked. The inflammation of the mouth and throat continues unabated, with anorexia and thirst. The urine is high colored, and in robust children, during the first days of scarlet fever, it frequently deposits the urates on cooling.

The symptoms continue with undiminished intensity for a period of from four to six days, when the fever begins to abate, the pungent heat becomes less, and the rash fainter. There is a gradual decline of the disease, which, in its inception, was abrupt. In mild and even pretty severe cases, which pursue a regular and favorable course, convalescence commences by the close of the first, or beginning of the second week. In the second week, the rash becoming less and less distinct, finally disappears; as do also the redness and swelling of the buccal and facial membrane. The engorgement of the papillæ of the tongue and that of the tonsils subside; the appetite returns; the countenance brightens, and becomes natural, and the child who, during the height of the fever, scarcely noticed objects, or noticed them with indifference, or even repugnance, can be amused as before his sickness.

The period of desquamation succeeds. Exfoliation of the epidermis occurs over the whole body. This commences about the face and neck, and it occupies several days, during which there is progressive improvement in the condition of the child. Where the skin is thin, the epidermis, as it is detached, presents a furfuraceous appearance; where it is thick, as upon the palms of the hands, and soles of the feet, it separates in a layer of considerable thickness.

Such is a brief account of scarlet fever, when it pursues its normal course, without complication or sequelæ. But there is no disease which has so many unfavorable complications and sequelæ as this. The liability to these renders the prognosis in all cases doubtful, and, in many instances, they are the immediate cause

of death. They occur both in mild and severe cases of scarlet fever.

The great difference in different cases of scarlet fever, as regards intensity of symptoms, is well known. It is sometimes so mild, its characteristic features so slight, that diagnosis is necessarily uncertain. Examples in corroboration of this statement are not infrequent. In the spring of 1866, I was called to an infant thirteen months old, who had slight pharyngitis, and an indistinct rash over a part of the surface. In two days the eruption had disappeared, and soon after the health was apparently fully restored. Diagnosis would have remained doubtful, except for sequelæ. In another instance, two children passed through the entire course of scarlet fever, playing every day in the street. Although the intelligent grandmother saw the rash upon them, its nature was not suspected till nearly two weeks afterwards, when one was taken with fatal nephritis and general anæmia. In cases so mild as those which I have described, the heat of surface is not greatly increased, nor is the pulse much accelerated. There is no restlessness, nor is the digestive function materially impaired. The rash does not have so deep a color, nor is it so continuous over the surface, as in cases of ordinary gravity. The patient begins to improve in from two to four days, and is soon well. So mild a form of scarlet fever is, however, quite exceptional, but there are all gradations from this mildness, to that malignant form which I shall presently describe.

There is usually considerable facial inflammation, even when scarlet fever pursues a regular and favorable course. If the pharyngitis is intense and protracted, many writers designate the disease *scarlatina anginosa*. There is, in these cases, not only general and pretty severe inflammation of the mucous membrane of the fauces, with swelling of the tonsils, and submucous infiltration, but also more or less tumefaction around the angle of the jaw, due to extension of the inflammation to the lymphatic glands, and cellular tissue of the neck. In these cases, the suffering of the patient is greatly increased by the amount of local disease. The adenitis and cellulitis, unless slight, do not subside with the disappearance of the rash, or they subside more slowly. They render the fibrile movement more protracted. The swelling due to these inflammations often continues one or two weeks after the disappearance of the rash, or even longer,

when it disappears by resolution, or more rarely by suppuration, the abscess opening externally.

Irregular Form.—The irregular form of scarlet fever is commonly due to some perturbing cause. This cause is often a pre-existing or co-existing disease, or, if not actual disease, at least disordered state of system. For example, a little girl, in my practice, had the symptoms of scarlet fever, such as febrile movement and inflammation of the buccal and faucal surface, nearly a week before the scarlatinous eruption appeared. During this period there were symptoms of enteritis, which declined when rash occurred. The abdominal affection was the apparent cause of the irregularity in the fever. If scarlet fever occurs during an attack of entero-colitis, there is frequently no eruption. Most practitioners have met cases like the following, which I now recall to mind: In a family where scarlet fever was prevailing, a little child, early after the commencement of symptoms which seemed to be plainly referable to the symptomatic affection, was seized with vomiting and purging, and the latter continued two, or, perhaps, three days, when death occurred. There were the symptoms and appearances of severe scarlet fever, but without the eruption. In another instance, an infant in the warm months having protracted entero-colitis, the usual summer epidemic of this city, was apparently affected with scarlet fever, which was present in the family. There were the characteristic symptoms, but the diarrhoea continued, and there was no rash.

In those, that are much reduced by any antecedent disease, as phthisis, or that have a disease, chronic or acute, which produces a decided afflux of blood towards an internal organ, the eruption is commonly tardy in its appearance, indistinct, or wholly absent. The diseases which most frequently render scarlet fever irregular are the fevers and phlegmasia. Some affections, occurring in connection with scarlet fever, do not change its symptoms, but themselves undergo modification. Scarlet fever occurring in a child having pertussis does not itself undergo any material change. The cough, not the fever, is modified (rendered milder), during the coexistence of the two.

Scarlet fever may, also, be irregular in those that are robust, free from any other disease, and without any appreciable perturbing cause whatever. I have, recently (1867), attended a young lady, whose previous health was excellent, and whose

brother was sick at the time with scarlet fever. This patient had considerable fever, with pretty severe pharyngitis, and though her surface was repeatedly examined, no eruption could be discovered. Two weeks subsequently, she became affected with severe nephritis, anasarca, effusion into at least one of the pleural cavities, and probably into the pericardium, the case ending fatally.

Rilliet and Barthez mention the irregular and incomplete character of the eruption in second attacks of scarlet fever, which, though uncommon, are met from time to time. Scarlet fever occurring a second time, sometimes presents all the features of the regular disease, and pursues its normal course, but it is much more apt to be incomplete and irregular, than the first attack. It is more apt to be irregular, if the interval between the two has been short, than if several years have elapsed.

Malignant Form.—This form of scarlet fever is in some epidemics common, while in others, it is rare. It usually commences with severe symptoms, those pertaining to the nervous system predominating, such as intense cephalalgia, with delirium. Many pass rapidly into coma, and die within two or three days. They succumb to the virulence of the scarlatinous poison, while the disease is still in its commencement. The rash in malignant scarlet fever is dusky. It disappears by pressure, and returns slowly when the pressure is removed. There is, therefore, extreme sluggishness of the capillary circulation. In some there is great restlessness. If placed in one position on the bed, they soon throw themselves in a half-conscious, or unconscious state, into another. They do not speak at all, or they mutter like those affected by the graver forms of typhus, calling the names of playmates, or talking about things which interested them when well. There is great elevation of temperature, the thermometer, placed in the axilla, indicating 105° , 105° , or even 107° , and the heat of surface is pungent, except when the case approaches a fatal termination. The pulse from the first is rapid, numbering from 120 to 160 per minute. Sometimes there is great heat of head and body, while the limbs are cool. This is an unfavorable sign.

Severe and dangerous nervous symptoms, as convulsions and coma, occur chiefly within the first three or four days. After this period, the danger is mainly from exhaustion. Those who

survive the onset of the disease, often have, in the course of a few days, severe pharyngitis, with inflammation of the lymphatic glands, and cellular tissue around the angle of the jaw, accompanied by external swelling. The pharyngitis is attended by more or less secretion of mucus or mucus-pus, which, sometimes collecting around the entrance of the larynx, causes noisy respiration, or even, if the system is greatly prostrated, embarrasses respiration by entering the larynx. The chief danger, however, from the pharyngitis, is due to the exhaustion which it causes. By rendering deglutition difficult, it interferes seriously with nutrition.

COMPLICATIONS.—Complications may occur in any form of scarlet fever, but they are most frequent in malignant or grave cases. The most common and serious complication, as regards the nervous system, is clonic convulsions. These occasionally occur at the commencement of the disease, before the appearance of the rash, and many, then, recover, but I have not seen, nor have I heard, in my intercourse with physicians, of any case which recovered, when convulsions occurred after the complete development of the eruption. On the other hand, some of the physicians of this city, of largest experience, inform me that they consider convulsions during the eruptive stage, as almost certain precursor of death. Convulsive attacks in scarlatina are probably due, in part, to congestion of the nervous centres, for we sometimes find, in young children, at the time of the seizure, and immediately before it, the anterior fontanelle prominent, and forcibly pulsating. The convulsion uniformly increases the congestion, but, as the latter antedates the former, its causative relation seems to be established. But the most important element in the causation of convulsions in scarlet fever is, probably, the presence in the blood of the scarlatinous virus. This, whatever its exact nature, may in my opinion cause convulsions, with or without the co-operating influence of congestion, much as one gives rise to them in cases of uræmia. Convulsions occurring at the commencement of scarlet fever are usually single. If repeated, they become more serious. Convulsions, after the appearance of the eruption, either end at once in coma, or they return at short intervals, with gradually increasing drowsiness, till coma supervenes.

The anginous affection in scarlet fever may be so severe, or assume such features as to constitute a complication. It may

become more serious than the primary disease itself, so as to require the chief treatment. During the recent epidemic of diphtheria in this city many cases were observed in which diphtheria and scarlet fever coexisted. As has been stated elsewhere, a pseudo-membranous formation upon the faucal surface, especially over the tonsils, is not uncommon in severe anginous scarlet fever, but it is soft or pulsatious, in isolated points or patches, and easily detached. On the other hand, in the case to which I have alluded, of diphtheritic complication, the pseudo-membrane is more firm and extensive, as in primary diphtheria. In one instance in my practice the coexistence of diphtheria and scarlet fever was very apparent. Two children in a family died after a short attack of malignant scarlet fever. Their throats were not examined. Another child took the disease and, being longer sick, it was more carefully examined. The diphtheritic pseudo-membrane was found on both tonsils, at the same time that there was a distinct scarlatinous rash, and, as additional proof of the coexistence of the two diseases, the father became affected with diphtheria without scarlatina.

An occasional result of severe pharyngitis in scarlet fever is suppuration, or gangrene occurring in the subcutaneous cellular tissue of the neck. Whether suppuration result with the formation of an abscess, or gangrene, this complication is often serious. Suppuration, or gangrene indicates an intense grade of inflammation or a low vitality; but many with this complication recover through a protracted convalescence.

If suppuration is extensive, it may so increase the debility that death occurs in consequence. Gangrene is a more serious complication; unless slight, it renders a fatal termination highly probable. The areolar tissue, subcutaneous or inter-muscular, is the part which primarily sloughs. The skin over the gangrene becomes brown or dark, and separates with the slough. In the majority of cases the slough is not large. Exceptionally it extends so deeply that when it separates, the muscles and even vessels of the neck are laid bare, and the appearance is hideous. In a case of this sort, which I saw a few years since in the practice of another physician, the cavity, after the slough had separated, was irregular, and sufficiently large to admit a hen's egg. It extended a considerable distance out of sight under the

skin, and finally opened a vessel from which fatal hemorrhage occurred.

Gangrene of the mouth, also, occurs in rare instances, either as a complication or sequel. I have met it in two cases, one of which recovered. In the fatal case, it began while the patient was still under treatment for the fever, and was first discovered by the loss of two incisors. The one that recovered also lost two incisors, and a part of the superior maxillary bone. The one that died was scrofulous, though its regimen was good; the other lived in a tenement house, and was ill-cared for. Killet and Bartholomew relate three cases of gangrene of the mouth, occurring, however, not as a complication, but sequel of scarlet fever. One of these patients had, within eighteen days, varioloid, scarlet fever, and measles; these diseases ending in fatal gangrene of the pharynx and mouth. The second child was taken on the seventeenth day after the commencement of scarlet fever, with gangrene of the pharynx, succeeded by that of the mouth, and died on the twenty-fourth day. In the third case, the gangrene was preceded by smallpox, as well as scarlatina. Other observers have recorded similar cases.

Another complication, to which allusion has already been made, is enterocolitis. This may annulate the symptomatic affection. In other cases, enterocolitis commences either with the scarlet fever, or during its course. Diarrhœa often occurs in connection with the vomiting, in the first hours of the fever; and it commonly ceases during the first or second day. Occasionally it continues with greater or less severity, when it constitutes a serious complication; it is in these cases due to intestinal inflammation. Bronchitis and pneumonia, so common in measles, do not often complicate scarlet fever.

A not infrequent complication is articular rheumatism. This most frequently occurs when the fever begins to decline, and, according to my observation in favorable cases, often in those whose symptoms are and have been mild. Attention is called to it by the complaint of the child of pain or tenderness in the affected joints; or, if he is too young to speak, by evidences of pain when the joints are pressed or moved. There are usually but little swelling and redness, and there are fewer joints affected than in most cases of acute idiopathic or primary rheumatism. In my practice, a common seat of scarlatinous rheumatism

has been the areolar tissue of the wrist. The inflammation and infiltration are less than in primary acute rheumatism. This complication is not, ordinarily, serious; nor does it, as a rule, materially retard convalescence. A physician of this city, however, informs me of two cases in which cardiac inflammation occurred in connection with the articular affection, as it so frequently does in idiopathic rheumatism. The urates are not so commonly present in the urine in scarlatinous as in ordinary acute rheumatism.

Serous inflammation, especially that affecting the peritoneum, pleura, or pericardium is a common complication, independently of the rheumatic affection. It occurs during the desquamative period, and, continuing afterwards, becomes a sequel. Many such cases are fatal. Pericarditis may be with difficulty diagnosed, if it is slight, and attended by only a moderate amount of effusion, and it is, doubtless, often the cause of death in those who die suddenly and unexpectedly, during, or soon after, an attack of scarlet fever. Pleuritis occurring in scarlet fever may be suppurative. In 1865, I attended a little girl in a mild attack of scarlet fever. When the fever had nearly ceased, and the exor was about being discharged, she was taken with severe pleurisy of the right side. The pleural cavity was soon half filled with liquid, and after a long sickness extending over two months, this liquid, mainly pus, established a communication with a bronchial tube, and was expectorated. She immediately recovered.

In the following case, the records of which are from my notebook, pericardial and peritoneal inflammation occurred as a complication of scarlet fever:—

CASE.—April 7th, 1866, C—, girl, five years ten months old, had measles two years, and hooping-cough two year ago. With the exception of a slight cough, she has since remained well, till the present sickness. Scarlatina commenced April 4th, and on the 5th, the eruption appeared. Symptoms severe, but regular; pulse 153, full; surface hot, and covered with the eruption; delirium at night; stomach irritable; constipation. April 8th to 10th, symptoms about the same; no delirium, however; pulse varying from 124 to 153 per minute; a deposit of urates in the urine.

11th. To-day, for the first, has severe pain in the epigastrium, accompanied by tenderness on pressure, and moderate distension at this point. The symptoms otherwise are favorable, though pretty severe; pulse 140; respiration moderately accelerated, but the rhythm natural; respiratory murmur distinctly heard in all parts of the chest, vesicular in character, and without rales. Has taken

till to-day mainly diaphoretic mixtures; to-day pale, (pneum. comp. gr. II.) every three or four hours, is ordered; a flaxseed poultice to be applied to the epigastrium; diet nutritious, with moderate use of stimulants.

12th. Epigastric pain still severe; great tenderness on pressure; considerable distension at this point, and percussion elicits a dull sound; passed a restless night; when asked where she feels pain, she points to the throat and epigastric region; pulse 120 to 140 per minute; rash fading; surface warm; bowels somewhat relaxed; urine passed in usual quantity. The treatment by Dover's power and poiltices is continued, and a leech is to-day applied to the epigastrium.

13th. Pain less severe, but considerable tenderness on pressure; pulse about the same as yesterday; has had through her sickness a slight cough. She talks rationally, and sits much of the time in bed.

14th. Continued in the same state as described in yesterday's records, till 2 P. M. yesterday, when she became suddenly worse; her respiration was short and gasping; she spoke, with an effort, in a whisper, but continued conscious; and her pulse was strong. Death occurred at 5 P. M., apparently from obstructed respiration. In the last days of her sickness, there was but little pharyngitis, and little or no external swelling.

Autopsy twenty-four hours after death.—Body a little emaciated; heart large for a child of five years; about one ounce of turbid serum in the pericardium; a soft deposit of lymph within the pericardial sac at the base of the heart, around the origin of the great vessels, evidence of recent circumscribed pericarditis; from four to eight ounces of transparent serum in each pleural cavity; no lymph upon or opacity of the pleural surfaces; mucous membrane of bronchial tubes injected in streaks, and mucopus can be pressed from them; both lungs can be readily inflated, with the exception of small portions of both the lower lobes, which are hepatized, and can be but partially inflated; liver enlarged, presenting a congested appearance, and extending some four inches below the free border of the ribs; upon its convex surface in the epigastrium, corresponding with the seat of the pain, is a white rough patch of lymph about one and a half inches in diameter; kidneys congested; stomach and small intestines apparently healthy; mesenteric glands moderately enlarged; mucous membrane of transverse and descending colon somewhat injected and thickened, showing mild colitis; no ulceration noticed: brain not examined.

Microscopic examination was made of the blood, hepatized portions of lung, &c., but nothing of special interest in this connection was observed.

This case is instructive as showing the liability which exists in, and after scarlet fever, to inflammations, and the difficulty of diagnosing them in certain cases on account of their circumscribed character.

SEQUÆLÆ.—The complications described above may occur as sequæla, but there is another pathological state which is not often

a complication, but is a common and serious sequel. I refer to nephritis with albuminuria. This usually commences from one to three weeks after the disappearance of the rash. There is sometimes, during the course of scarlet fever, and even subsequently, slight albuminuria due to simple congestion of the kidneys; but the albuminuria which occurs as a sequel of scarlet fever, and which requires treatment, is more serious. Its anatomical character is as follows: hyperæmia, and perceptible increase in volume of the kidneys; a granular deposit in the renal epithelial cells; the escape of albumen from the engorged capillaries, and its appearance in the urine; the formation of fibrinous casts in the tubuli uriniferi, these casts often containing more or fewer epithelial cells; the escape of the casts from the kidneys with the urine; diminution of amount of urea excreted, and, therefore, its accumulation in the blood; and finally rupture of the engorged capillaries of the kidneys, and mingling of the elements of the blood with the urine.

The presence, therefore, of this renal affection can be readily ascertained by examining the urine. The quantity of albumen which this liquid contains can be approximately ascertained by adding nitric acid or applying heat. If the quantity is small, simple cloudiness is produced; if large, the urine becomes thick and white, and in extreme cases almost semi-solid from coagulation of the albumen. The character of the urine can, however, be more accurately ascertained by the microscope than by the tests which have been described, since by it we discover the fibrinous casts, altered epithelial cells, and blood corpuscles.

Nephritis, with the consequent œmia, soon gives rise to evident symptoms. Serous effusion takes place, the most common form of which is anasarca, occurring upon the face and limbs and sometimes in the areolar tissue of the trunk. Often the effusion occurs only in the external areolar tissue, and the result is then ordinarily favorable, but in other cases it occurs, and in the order mentioned as regards frequency, in the lungs (œdema pulmonum), serous cavities, and, lastly, in the areolar tissue of the larynx, constituting œdema glottidis. The internal effusion should excite the gravest apprehensions, as it is often fatal. Fortunately, it is in most cases preceded, as well as accompanied by, anasarca, which is easily detected, so that there is sufficient forewarning. The

fact of an occasional exception to this rule should be borne in mind.

Scarlatinous albuminuria sometimes occurs quite abruptly and often when the patient has been progressively convalescing, and, perhaps, has seemed out of danger. In most cases, however, there are well-marked precursory symptoms, as fever, restlessness, loss of appetite. The anasarca is first observed in the face or about the ankles. Sometimes it remains inconsiderable, but in other cases it increases day by day, more or less rapidly, till the appearance of the patient is much altered. In marked cases of anasarca the features are so bloated that their natural expression is lost. The volume of the trunk and legs is augmented, and, more slowly, that of the arms. In the male child the penis and scrotum frequently attain three or four times their normal dimensions, in consequence of serous infiltration.

The duration of the anasarca or dropsy is very different in favorable as well as unfavorable cases. If the form be *oedema pulmonum*, *oedema glottidis*, or inter-cranial effusion, death is speedy. It may occur even within a day. *Hydrothorax* and *hydropericardium* are also ordinarily fatal, though not so speedily; while in *ascites* the prognosis is much more favorable. The duration of anasarca under the most favorable circumstances, unless it is very slight, is commonly not less than two or three weeks, and it is often much longer. There is another and an important source of danger apart from the serous effusions, namely, the retention of urea in the blood. Convulsions, coma, and death may occur from uræmic poisoning, as in Bright's disease. In these cases there is great and continued scantiness of urine, in consequence of obstruction in the tubuli uriniferi from fibinous casts and granular and swollen epithelial cells.

The occurrence of this renal affection after scarlet fever is, as a rule, during the period of desquamation. The liability to it is greatly increased, and in some cases is mainly attributable to the close relationship, as regards their functions, which exists between the skin and kidneys. A common exciting cause is exposure to vicissitudes of temperature or currents of air, by which the surface is chilled and cutaneous transpiration checked, at the time when the old epidermis is being detached. The increased burden thrown upon the kidneys results in the pathological state which has been described. All who have seen much of scarlet

fever can recall to mind cases in which the patients had nearly recovered, when from some needless exposure in the streets, or by chilling of the body in a cold room, or open window, this affection occurred with, perhaps, a fatal result. Elsewhere I have alluded to a case in which scarlet fever was only detected by this sequel, which began when the child was daily exposed in the open air. But many children who have been attended with the utmost care, and who, through the whole desquamative period, are kept in a uniform temperature, nevertheless become affected with albuminuria and dropsy, so that there is sufficient cause of this sequel in the state of the child and the nature of the disease through which he has passed, apart from extraneous influences. It is an interesting fact that albuminuria is more apt to occur after mild than severe cases of scarlet fever, and observations show that this difference in liability to albuminuria is intrinsic; in other words, that it does not depend, as some have supposed, on a difference in the hygienic management of mild and severe scarlatina.

The *symptoms* in scarlatinous nephritis vary not only according to the degree of the inflammation, but also according to the amount and seat of the effusion. I have stated that it usually commences with languor and more or less fever. The pulse remains accelerated, the skin is hot and dry, and the appetite poor. This affection, if slight, may occur without appreciable effusion, either in the cellular tissue or the cavities, but ordinarily in these mild cases a little puffiness is observed around the eyes, or upon the extremities. In the majority of cases, more extensive anasarca results. The skin is then pallid, distended, and pitting on pressure. The anasarca does not, in most instances, give rise to any marked symptoms. If œdema glottidis or pulmonum occur, the respiration becomes rapidly more embarrassed, till soon the blood is no longer sufficiently oxygenated for the purposes of life. The chief symptom in hydrothorax is accelerated and difficult respiration; in hydropericardium, the symptoms are such as arise from embarrassed action of the heart; in ascites there are either no marked symptoms, or, if the amount of liquid is large, there may be more or less embarrassment of respiration from compression of the lungs.

Otitis.—Inflammation of the external ear, giving rise to otorrhœa, is a frequent sequel of scarlet fever. It sometimes commences as a complication in the last stages of the fever; at

other times it begins during convalescence. It often produces a degree of deafness, which, in most instances, soon passes off. A thin, purulent discharge from the ear may remain for months or even years, and hence the name which designates this affection. In exceptional cases, internal otitis occurs. This is a more serious sequel; it may impair the hearing permanently. There are cases in which not only the drum of the ear is destroyed, but the ossicles are detached, and lost through the external ear. Complete deafness then results. I have met one case, in which both ears were so injured by scarlet fever in infancy, that the child grew up a mute. The result is sometimes still more serious. The inflammation may extend inwards, causing caries of the petrous portion of the temporal bone, till it reaches the lateral or petrosal sinuses. The inflammation then causes thickening and bulging of the walls of the sinuses, and, consequently, partial obstruction to the circulation, congestion in the veins and sinuses, the formation of thrombi, and, finally, coma and death. Fortunately, this melancholy termination of scarlatinous otitis is not frequent.

ANATOMICAL CHARACTER.—There is some difficulty in determining what are the anatomical characters of scarlet fever, since so many who die of this disease have a complication, and the lesions of this are superadded to those of the fever. The following, however, are the facts, which have been ascertained in reference to this point. In many the brain, its membranes, and the lungs are congested; often, also, the Peyerian, solitary, and mesenteric glands are enlarged, and the spleen enlarged and softened. The liver and kidneys do not present any notable alteration, though the latter are so often affected during the period of convalescence. Dr. Samuel Fenwick (*London Lancet*, July 24, 1864) has made post-mortem examination in sixteen cases of scarlet fever, and concludes from them that there is inflammation of the mucous membrane of the stomach and intestines like that of the skin, and that there is desquamation of the epithelial cells from these portions of the digestive tube like that of the epidermis. Further examinations are required in reference to this point. In malignant cases the blood is dark, and the heart clots soft and small; in other cases the color of the blood may be nearly normal, and the heart clots of the usual size and firmness.

NATURE.—Scarlet fever presents in a marked degree the dis-

tingular features of the zymotic affections. It is highly infectious; it is also inoculable. Stoll, d'Amboise, and others successfully inoculated with the scarlatinous virus, using, I believe, the blood, but without diminishing the intensity of the disease. Whether scarlatina ever originates spontaneously is uncertain; but if it do, such cases are rare. It ordinarily spreads through a community by infection, though the distance to which it is infectious is short, probably not more than two or three yards. Some consider it to be even less than one yard. Knowledge of this fact is important, as by isolating in a family a child attacked by scarlet fever, and allowing no communication with the nurse, the other children often escape. A very common mode of communication is by clothing, so that a third person is the medium of transmission. I have noticed that when scarlet fever as well as measles is epidemic in this city, a large proportion of the cases, nearly all, indeed, of the first cases, can be traced to the public schools. Exposure occurs through those children who come from apartments where cases are under treatment. Physicians, and especially nurses, are sometimes the medium of communication. A medical friend of mine went directly from some children with scarlet fever, whom he was attending, to another family, where he took a little girl upon his knee. This girl, in a few days, became affected with scarlet fever and died. The two remaining children in the family were then attacked and one died. Marshall alludes to similar cases (*London Lancet*, August 13, 1864). In one instance in my practice scarlet fever was communicated to an infant by a washwoman whose own child had the disease, and who, on reaching the house where she had been engaged to work, threw her shawl over the cradle where the infant was sleeping. Six days later the infant was attacked. Mason Good cites a case where a box of toys was the medium of communication; and it is said that also a letter has been. The scarlatinous virus may remain for weeks and even months in apartments, clothing, or in or upon the person of one, who has been affected, without any appreciable diminution in its effectiveness. A physician of this city, in whose family scarlet fever occurred, kept a child from the room occupied by the patients, and from the patients themselves, for a month after the last case occurred, and yet, although precautions had been taken in reference to clothes and bedding, this child was taken with

scarlet fever soon after it was allowed to mingle with the other children. The father believes that the exposure was through the excreta of one of the children. In a case in my practice a little girl returned home six weeks after her brother had scarlet fever, and, within a few days, took the disease. A more striking example occurred in the practice of Dr. Kearner Rogers, formerly a prominent and much esteemed surgeon of this city, and was related to me by an intelligent friend of the family since the doctor's death. Six children in a family had scarlet fever. Three and a half months subsequently another child, living at a distance, was allowed to visit them in the apartments where they had been sick. One week from that day this child became affected with the disease. Dr. Ellipton states that a patient with scarlet fever was admitted into one of the wards of St. Thomas's hospital, and, for two years subsequently, young persons who were admitted into this ward were apt to take the disease. Dr. Richardson relates the case of a family of four children residing in the country. One died of malignant scarlet fever, and the rest, who had been removed, escaped. Some weeks subsequently one of the children returned, but, within twenty-four hours, took the disorder and died. The cottage was now thoroughly cleaned, whitewashed, and the clothing destroyed. Four months then elapsed, when the third child returned home, who also took scarlet fever in a malignant form and died. It was believed that the virus remained attached to the thatch, which extended close to the children's bed. Other similar examples might be mentioned sufficient to establish the fact of the great permanence of the scarlatinous virus.

The period of incubation in scarlet fever varies. It is seen in the remarkable example of contagion, given above, that it was only twenty-four hours. Trousseau also relates an interesting example of short incubation. "An English gentleman with his daughter was returning from Pau to London, and was joined at Paris by another daughter, who came direct from London. Scarlet fever was prevalent in London, but there was not a case of it at Pau. The second daughter was seized with scarlet fever in crossing the channel, and joined her relatives in Paris seven or eight hours later. She occupied the same room in the hotel as her sister, who was also attacked within twenty-four hours." The incubative period is, however, seldom so short. It is usually

from three to eight days. I might cite several cases in which this was its duration. Some writers allude to cases in which two, three, or even four weeks elapsed, from the time of exposure to the appearance of the disease. It is, however, a question whether in such cases there may not have been a second, and more recent exposure. Bostan alludes to cases, in which scarlet fever was communicated by inoculation, and in which the period of incubation was seven days.

Scarlet fever occurs most frequently between the ages of three and ten years. It rarely occurs under the age of one year, and infants under the age of three months may be considered safe from an attack of it, though fully exposed. Cases have been reported of scarlet fever occurring in the foetus, and manifesting itself by the usual signs at birth. But a clear diagnosis in such instances is necessarily difficult, on account of the character of the scarlatinous eruption, on the one hand, and the nature of the cutaneous circulation in the newly-born on the other. It is probable that, in the cases alluded to, there was an error of diagnosis. Certainly in two instances I have known women immediately after their confinement (within a week), take scarlet fever, and although they communicated the disease to others, did not to their infants. Murhison states that twice he has known women with scarlet fever to be confined, and in both instances the infants were healthy.

Most adults possess immunity from scarlet fever, although not protected by an attack of it in childhood. Parturient women, however, are liable to it, and there is considerable danger that the physicians who attend them, if at the same time visiting cases of scarlet fever, may communicate the disease to them.

Scarlet fever is sometimes sporadic, but as we meet it in this country, it occurs most frequently as an epidemic. The epidemics vary greatly in type. Some are mild, and attended by few complications, so that the result of treatment is eminently satisfactory. In other epidemics the type is malignant, the complications frequent, and the percentage of deaths large. There is sometimes a succession of epidemics of one type, and then the character of the disease changes. This fact of a variable type is important as regards the value of statistics relating to treatment. Each epidemic has its prevailing character, but when the form is mild, there is now and then a case of severity, and when it is malignant,

now and then one of unusual mildness. The epidemic influence is sometimes manifested in those exposed to scarlet fever by the occurrence of more or less pharyngitis. Professor George B. Wood, of Philadelphia, says (*Treatise on the Practice of Med.*): "I seldom attend cases of scarlet fever without having sore throat."

Scarlatina usually occurs but once in the same individual, but a second attack after the lapse of several years is not uncommon, and there are even cases on record of a third attack. But physicians sometimes mistake roseola or erythema for scarlet fever, and, though afterwards aware of their mistake, do not correct their diagnosis. Hence there is a belief in the community that second attacks of scarlet fever are more frequent than they really are.

DIAGNOSIS.—In the commencement of scarlet fever, prior to the eruption, there are no symptoms or appearances which will enable us to make a positive diagnosis. Positive statement in reference to the nature of the disease might better be deferred, for the credit of the physician. Still, if a child with regular bowels, and no appreciable local disease, a few days after exposure to scarlet fever, is suddenly seized with intense fever, the pulse rising to 110, 120, or more, and the temperature to 102° , 103° , or 105° , there is little doubt that the disease is scarlet fever. The diagnosis is rendered more certain if there is vomiting, and especially if, as is often the case, there is, at this early period, a bluish redness upon the fauces.

When the eruption has appeared, the nature of the affection is, in most cases, apparent. Still, roseola, or erythema, due to intestinal derangement or other causes, has often, as already stated, been mistaken for scarlet fever. A day or two suffices to show the error. In scarlet fever there is more inflammation of the facial and buccal surface, more continuous and persistent redness of the skin, and greater intensity and persistence of symptoms than in those diseases. Scarlet fever is also further distinguished from them by the papular elevations upon the tongue, and the minute papule upon the skin. Besides, in scarlet fever, except in the mildest cases, there is from the first the aspect of serious sickness, which roseola and erythema do not present.

Scarlet fever and measles were long considered identical by the profession, and though the ordinary forms of the two diseases can be readily distinguished from each other, there are instances in which the differential diagnosis is attended by some difficulty.

Measles occurring in a robust child, with an active sanguineous circulation, sometimes presents a continuous eruption over a considerable part of the surface, like the eruption of scarlet fever. But the longer period of invasion, the coryza and bronchitis, and the absence or slight degree of pharyngitis in connection with other symptoms, enable us to distinguish these cases from scarlatina. Moreover, in these cases of measles in which there is continuous redness of surface where the circulation is most active, as upon the face, the characteristic rubellous eruption is present in other parts, so that with care in examination, error of diagnosis may be avoided. Scarlet fever and measles may indeed occur together, but such a complication is rare.

The greatest difficulty of diagnosis occurs in atypical scarlatina, especially when the rash is partial and indistinct. There is apt to be, in this form of the disease, an inflammatory complication, which causes withdrawal of blood from the surface, and it is sometimes very puzzling to decide whether this is a complication, or the sole disease. The points involved in diagnosis are numerous, but they are sometimes not sufficient to show the character of the affection. Generally, however, by observing the clinical history, from day to day, the diagnosis is established. In cases of doubt it is safest to adopt such hygienic management as is appropriate to scarlet fever.

PROGNOSIS.—The prognosis depends on the form of the disease, whether mild or severe, the presence or absence of complications, and the strength of the patient. The mortality varies greatly in different epidemics. In epidemics of a mild type, the mortality is sometimes not more than one in twelve, and the ratio may be less; whereas, if a severe form is prevailing, not more than one recovers in every two, three, or four. The mortality is greater in the city than country; in hospital than in private practice. Killian and Bartholin, in hospital practice, lost forty-six out of eighty-seven. Scarlatina is, of itself, less fatal than statistics would lead us to suppose, since a large proportion of those who die in consequence of it die from complications or from sequela, rather than from the primary disease.

The symptoms, in the first days of scarlet fever, which indicate an unfavorable termination are convulsions, except at the very commencement, great drowsiness, with jactitation, great elevation of temperature, a rapid pulse, duskiness of the eruption, and feeble

capillary circulation. At a later period, particularly in the second week, other unfavorable symptoms may occur in malignant and fatal cases. Violent pharyngeal inflammation, with great external swelling from the adenitis and cellulitis, is apt to be present at this stage of the disease. Severe inflammation of this character, as indicated by the tumefaction, greatly increases the danger.

As there are several complications, and sequelæ of a dangerous character, and as these are apt to occur suddenly, and often without appreciable existing cause, in mild as well as severe cases, it is unwise ever to make an unconditional favorable prognosis. The patient is not to be considered entirely safe till two or three weeks have elapsed after the eruption.

Some patients who have passed through scarlet fever, die of asthenia, in consequence of the atonic state which the fever has produced. They have not sufficient vigor of system to recover, although no serious complication or sequelæ has occurred. But the mortality in the desquamative stage, and subsequently, is more frequently due to the renal affection, which is so common, than to any other cause. This affection gives rise to dropsies, which are fatal, or to uræmic convulsions, and coma. Sudden and unexpected deaths are not uncommon in scarlet fever, and it is probable that, in many of these cases, the immediate cause is uræmia, which, not having produced any conspicuous symptoms till near the close of life, is not discovered.

CHAPTER IV.

TREATMENT OF SCARLET FEVER.

SCARLET FEVER, when mild, and without complication, requires little treatment. A gentle cathartic, like the citrate of magnesia, should be given from time to time, if there is a tendency to constipation, and a simple diaphoretic mixture in addition, is all that the case requires.

℞—Elix. æther. alic.,
Syr. Ipecac., ℞ ʒi;
Syr. simplic. ʒi.
Mise.

Dose, one teaspoonful every three hours to a child of three to five years.

If there is restlessness, an occasional warm mustard foot-bath will give relief, and if there is considerable fever, as indicated by flushed face, heat of head, cephalalgia, or other nervous symptoms, cool applications should be made to the head, and the face and forehead occasionally bathed with cool water, bay rum, or other cooling lotion. The mildest cases indeed commonly do well without treatment, except hygienic, though it may be necessary, in consequence of the impatience of the family, to prescribe a placebo. When the fever has begun to abate, in such cases, if the appetite returns, and there is no complication, and no symptom of feebleness, there is little for the physician to do. But if, as is sometimes the case, even when the disease has been mild, the appetite remains poor, and the aspect is anæmic, tonics are required, especially chalybeates.

The majority of cases, however, demand more decided measures than those described above. We pass to the consideration of cases of moderate severity, and those of a grave character. *Trousseau* recommends cold affusions as an important part of the treatment. They should be employed in the first stages of æthénic cases. They are especially beneficial, it is stated, in those cases in which nervous symptoms predominate. The patient is placed naked in a bathing-tub, and three or four pails of water are thrown over him, in a space of time varying from a quarter of a minute to one minute, after which he is covered with bed-clothes, without being wiped. Reaction immediately occurs, often with more or less perspiration. This treatment is repeated once or twice daily, according to the gravity of the symptoms.

"Dr. Currie," says *Trousseau*, "was the first who made use of this treatment, and he established its applicability, as a general rule, in scarlatina accompanied by grave nervous accidents, such as delirium, convulsions, diarrhoea, excessive vomiting, considerable exaltation of the heat of surface." *Trousseau* believes that cold affusions diminish the febrile movement, and calm the nervous excitement, and he further adds: "I have never administered it without deriving some benefit." Public opinion is, however, so averse to such treatment of the eruptive fevers, that one of less authority than *Trousseau* would scarcely be able to employ it. The shock of such treatment to a child not sufficiently old to be reasoned with must be considerable, and it would

seem questionable whether the excitement from such a measure may not increase the liability to clonic convulsions.

In the cases alluded to by Trousean, in which there is great heat of surface, and nervous symptoms predominate, though cold affusions are not used, there is no doubt of the beneficial effect of cold applications to the head, and sponging the face and arms. This may be frequently repeated if there is great elevation of temperature.

The medicinal treatment of scarlet fever has varied greatly at different periods, according to the theory which happened to prevail, and it is even now far from uniform. Physicians, however, generally, prescribe sustaining measures. If catarrhis occur, as the fundamental pathological process, in scarlet fever, and the other so-called zymotic diseases, and if we possess safe anti-catalytic medicines, which will arrest this process, these agents are in all cases required. But the use of anti-catalitics is still experimental, and they are not therefore to be recommended in place of remedies which have been long employed, and are known to be of real value.

Depletion is rarely required in scarlet fever; on the other hand, sustaining measures are indicated from the first. Bloodletting, formerly more or less employed in the treatment of this disease, is now almost obsolete. In no instance is venesection required. In rare instances, in robust children having an active circulation and a decidedly sthenic form of the disease, there might be a condition in which one or two leeches would be serviceable; as, for example, leeches applied to the temples, if there is evidence of dangerous cerebral congestion. But in these cases a sufficiently sedative or tranquillizing effect can, ordinarily, be produced by the application of cold to the head, cold ablutions to the face and hands, and by an occasional warm general or foot-bath. In all malignant cases, measures which reduce the vital powers cannot fail to be injurious. In those cases which are properly designated by that name, there are often evidences of prostration from the first, as drowsiness, pectitation, delirium, languid circulation, evinced by the dusky hue of the surface. These symptoms indicate the need of stimulants.

In the ordinary as well as severe forms of scarlet fever, carbonate of ammonia, administered with a tonic, is one of the best remedies. It is moreover recommended by the best authorities.

It may be prescribed at the first visit of the physician, and continued at regular intervals. It is used as a main remedy by many judicious and skillful practitioners. I ordinarily prescribe it in combination with citrate of iron and ammonia.

R.—Ammon. carbonat.,
Ferri et ammon. citrat., \mathfrak{ss} 3ss;
Syr. simple. \mathfrak{ss} .
Misce.

Dose, one teaspoonful every three hours to a child of five years.

The preparations of cinchona are also useful tonics.

An unpleasant symptom in most cases, and one which increases greatly the restlessness of the patient, is itching of the skin. The safest and best remedy for this is inunction. Fresh lard has sometimes been employed for this purpose. It relieves the dryness, and in a measure the heat of surface, and at the same time diminishes the itching. The odor from the lard is, however, offensive after it has been used for a day or two. An equally efficacious, more agreeable, but more costly substance for the inunction is glycerine, which may be applied pure, or scented with one of the essential oils. Dr. J. F. Meigs recommends the following:—

R.—Glycerine \mathfrak{ss} ;
Ung. *aq. rose* \mathfrak{ss} .
Misce.

The inunction should be made with the palm of the hand, or with muslin or linen. Those parts of the surface which are the seat of itching should be frequently treated in this way, and occasionally the application may be made over the entire surface. Not only does inunction have the local effect which has been described, but it is stated to diminish sensibly the rapidity of the pulse and the general temperature of the body.

The cases which require the closest watching and the most judicious management are those of an ataxic character. These cases are characterized by nervous symptoms, as jactitation, drowsiness, delirium. There is great heat of surface, while the capillary circulation is sluggish. Sometimes the rash is indistinct. In such cases a general warm bath is useful, to which mustard is added in sufficient quantity to cause some irritation of the surface. This not only quickens the capillary circulation, producing a better color of the rash, or causing it to appear, if

its development is retarded, but it calms the nervous excitement, and is often instrumental in preventing convulsions. If convulsions occur, which are attended by disappearance of the eruption, the bath should be employed at once. In grave cases, in which the rash is indistinct, some physicians, whose opinions are entitled to consideration, employ belladonna in sufficient dose to cause an eruption. I am not aware, however, that the severity of scarlet fever is diminished by this agent, as thus employed, although the disease is apparently rendered more normal by its use, so far as the rash is concerned.

The pharyngitis demands attention in most patients. Various modes of treating this have been recommended. The application of leeches to the throat, once a common practice, in severe scarlatinous pharyngitis, has fortunately fallen into disuse. If the pharyngitis might be diminished by leeching, which is doubtful for this form of inflammation, the benefit is more than counterbalanced by the evil effect, as regards loss of strength, which results from depletion. The application to the throat of a cloth wrung out of cold water, or containing pounded ice, has been recommended; but the continued wetting of the patient, which such treatment necessitates, and the danger from constant cold applications of chilling the body, and causing retrocession of the eruption, would deter the prudent practitioner from employing such measures.

After making use of various applications, I have been led to regard with most favor the use of a slice of salt pork, cut as thin as possible, and stitched on a single thickness of muslin or linen. The pork should pass from ear to ear, the cloth being tied or pinned over the vertex. It is best to sprinkle salt, or salt and pulverized camphor, upon the pork in order to secure a more prompt effect. If the application is properly made, the surface usually begins to be reddened in twenty-four hours, and, by the second day, an impetiginous eruption appears upon the part covered by the pork. Counter-irritation gradually produced in this manner causes little suffering. Patients, ordinarily, do not complain of it at all. This application should be continued through the fever, being occasionally left off for a day or two, as too much soreness is produced, and a linen cloth smeared with sweet oil, or some simple ointment applied in its place.

This simple external treatment diminishes the inflammation of the mucous membrane underneath, and also that of the lymphatic

glands and cellular tissue, in those severe cases in which these parts are implicated, so that tumefaction and suppuration, about the angle of the jaw, is less likely to occur. A well-known physician of this city, who has had ample experience in the treatment of children's diseases, ordinarily applies a small blister over the most prominent part of the swelling at the earliest moment, and by the vesication believes that he often succeeds in materially diminishing the inflammation. But counter-irritation in the manner which I have advised has the advantage of being less painful while it is equally effectual, and the irritated surface heals readily. I have never known the eruption produced by pork assume a gangrenous, phagedenic, or otherwise unhealthy appearance. This treatment does not always prevent a considerable degree of inflammation and tumefaction, but if properly employed it does diminish more or less this local affection. If there is external swelling which counter-irritation does not remove, and it becomes red and painful, irritating applications are no longer proper. Emollient poultices are now required.

Most cases of scarlet fever do not require direct applications to the inflamed faucial surface. Gargles, containing chlorate of potash, or one of the astringent preparations of iron, have been recommended, and also brushing the throat with the nitrate of silver solution, twenty grains to the ounce. Only children of an advanced age can, however, use gargles satisfactorily, and the use of the probing, except when the anginous symptoms are urgent, is more apt to do harm than good on account of the struggles and fright of the child, and consequent exhaustion. Dr. Lyons, from observations made in Dublin hospitals (*Medical Press and Circular*, May, 1866), recommends chlorate of quinin in solution, with a little perchloric acid as a remedy in scarlet fever, especially of the anginous form. Its effect is probably in part local. Experience, however, in the use of this agent is too limited to afford reliable data for judging of its efficacy, or to determine whether it possesses any advantage over the salts of quinin, which are in common use. In anginous scarlet fever, I know no better remedy than the tincture of the chloride of iron in combination with chlorate of potash, as recommended in the treatment of diphtheria. While its local effect is beneficial, as regards the throat, it strengthens the system generally. Yeast is

also useful in many of these cases, given in the quantity of half a teaspoonful to a teaspoonful several times daily. As it is swallowed it touches each part of the throat, and, if no drink is allowed for a few minutes afterwards, it produces a healthy, stimulating effect on the diseased surface.

Sometimes, in feeble children, viscid mucus collects in the pharynx and around the aperture of the glottis, so as to interfere with inspiration. In these cases there is danger of death from apnoea. Prompt interference is required. Swabbing the throat removes the mucus, which is attached to the swab, or is expectorated by the forced cough, which the operation causes. The swabbing may be performed by a piece of whalebone, bent at the end and wound with linen or soft muslin. I have usually employed it dipped in yeast, or a solution of chlorate of potash. I have sometimes relieved the most urgent dyspnoea by this means. An accumulation of mucus in the pharynx or larynx so as to require mechanical interference is most frequent in infants.

The diet in scarlatina should be nutritious, consisting of animal broths, milk porridge, and the like. The patient will rarely take solid food, except in the mildest cases. Those affected with grave forms of the disease require nutriment, as regularly, night and day, as in typhus and typhoid fevers.

In mild cases, alcoholic stimulants are not required, unless in moderate quantity towards the close of the disease. In severe cases attended from the first with great prostration, they are needed throughout the entire course of the fever. Wine whey or milk-punch should be regularly administered in quantity according to the age of the child. The presence of severe nervous symptoms, as agitation or delirium, in these asthenic cases, should not deter from its employment. Convulsions and coma are, indeed, less likely to occur, if stimulants are used, since the scarlatinous virus is, in a measure, counteracted by such agents. The apartment, in which the patient is treated, should be airy and ventilated, without exposure to currents of air. The temperature of the room should be uniform, about 68° for robust children, with high fever; about 70° for feeble children. It should be a little more elevated, after the fever has abated, and the desquamative period commenced, than during the fever. The patient is,

indeed, especially liable to be affected by changes of temperature, and currents of air, in the two or three weeks succeeding scarlet fever, and this exposure is very apt to result in inflammations, such as have been described. Hence, also, great care should be exercised in reference to the hygienic management of the patient during convalescence. In stormy weather he should be kept indoors for a month or six weeks.

The nephritic affection which is so common a sequel of scarlet fever, is often more dangerous than the primary disease itself. A clear appreciation of its therapeutic indications is important, since by judicious treatment many recover, whose lives would inevitably be sacrificed by improper measures. As there is, in these cases, active hyperæmia of the kidneys, having in most cases an inflammatory character, diuretics which stimulate these organs should not ordinarily be given, at least till this pathological state has, in a measure, abated. As the eliminative functions of the skin, and of the intestinal mucous surface are, to a considerable extent, vicarious with that of the kidneys, diaphoretic and purgative remedies are required. By free diaphoresis, the ill effect of arrested or diminished renal secretion is, for a time, averted. Treatment to produce diaphoresis should vary somewhat in different cases. It should, in most patients, be commenced by the use of a warm general or foot-bath, and the patient then be covered in bed. If free perspiration is not produced, it may be promoted by placing against the patient one or more bottles of hot water, surrounded by a wet cloth. The steam arising from this, and enveloping the body and limbs, produces a prompt sudorific effect. There is in use, in this city, in the treatment of these cases, a convenient apparatus for generating steam made by Rouchette, of 12 Fulton Street. It consists of a cylinder pierced with holes for the admission of air, and containing a spirit lamp, over which is a pan or pail holding a little water. The patient nearly denuded is placed in a chair, with the apparatus by his side, and is covered with a blanket, so that the steam surrounds the body. This gives rise to free perspiration, which continues after the patient is placed in bed. This treatment may be repeated each day, if the patient require it, while diaphoretics or cathartics are given.

The diaphoretics, which are most serviceable in this affection,

are the acetates of ammonia and potassa, the bitartrate and citrate of potassa. *Spiritus æther. nitrici* combined with either of these increases the effect, if the surface is warm, especially if there is already diaphoresis from the bath or steam. *Spiritus Mindereri* may be given to a child of five years, in doses of two teaspoonfuls every two or three hours, either alone, or in combination with sweet spirits of nitre, as in the following formula:—

R.—*Spts. æther. nitrici* ℥ssj
Liq. ammon. acetat. ℥iv.
Mise.

The acetate of potash is a more agreeable medicine, and it is generally quite as effectual. It should be given dissolved in water or syrup, in doses of about one grain for each year of the child's age. Whatever diaphoretic is used has more effect, as has already been stated, if given in connection with the external measures designed to produce diaphoresis, which have been described above. If perspiration is not produced, the action of the medicine is, probably, on the kidneys, and if diuretics do not result there is danger that the hyperæmia of the kidneys will be increased. In such cases diaphoretics should be omitted, and cathartic medicines given in place; or, if there is much exhaustion, it is sometimes better to give no eliminative medicine, and to treat the renal affection mainly by local and external measures.

In robust children suffering from scarlatinous uræmia, and serious effusions, no medicines afford so much relief in the commencement, as cathartics of a hydragogue nature. A mixture of jalap and cream of tartar, pulvis jalapæ compositus of the pharmacopœia, meets the indication. Even in children somewhat reduced medicines of this nature are often required. Cathartics are more certain in their effects than either diaphoretics or diuretics, and, therefore, they should be given in urgent cases in which it is necessary to remove the uræa or serum as speedily as possible. When cathartic or laxative agents have been used two or three days, the kidneys being less congested, in consequence of the diversion that has occurred, often begin to excrete more regularly. Subsequently to the employment of medicines of this kind or in connection with them, diaphoretics are, in most cases, required. The physician's experience and his discrimination in

reference to the condition of the patient will guide him in the selection of proper remedies to meet the indications.

In a large proportion of cases, when this renal affection has been continued one, two, or three weeks, the treatment, which has been recommended above, is no longer appropriate. There may be more or less anasarca and albuminuria, but the patient is anæmic, and evidently in need of sustaining measures, while there are no symptoms which indicate immediate danger from retention of urea or the excess of liquid in the system. In these cases the tincture of the chloride of iron is a most useful medicine. While it serves as a tonic, it does seem also to have a diuretic effect. To a child of five years it should be given in doses of five drops, every three or four hours.

If the patient is decidedly anæmic and feeble, when the renal affection commences, and the symptoms are not urgent, it is best not to administer diaphoretics and cathartics, or to administer them sparingly, and to commence early with sustaining remedies, especially iron. Such a case I have recently treated. A little boy, pale and of scrofulous aspect, began to have anasarca, after scarlet fever, chiefly of the scrotum, and accompanied by a moderate degree of uræticæ. The urine, which was passed in nearly the normal quantity, contained albumen. This patient gradually and fully recovered, with no treatment except the use of an eel-silk jacket over the kidneys and abdomen, to promote diaphoresis, and the use of iron. Such a case actively treated by eliminatives would, probably, have proved fatal. Uniform treatment for scarlatinous nephritis is therefore injudicious; considerable variation in measures is demanded, according to the state of the patient.

It is evident, from what has been said, that every possible precaution should be taken to prevent the patient's catching cold during the period of convalescence. He should not be allowed to go in the open air in unpropitious weather till a month after the fever. An eel-silk protection of the body, worn from the time that the febrile symptoms begin to decline, and covering the lumbar region, diminishes, in my opinion, the liability to nephritis and uræmia.

Since the period of Jenner's discovery of the prophylactic power of vaccination, as regards smallpox, the attention of the profession has been frequently directed to the prevention of

scarlet fever. A medicine has been sought for, that would antagonise and mollify, if not entirely prevent the disease. Of late years, it has been claimed that belladonna, given during the period of exposure, and subsequently, is a preventive. The first employment of this agent for such a purpose, was based entirely on theoretical grounds, it being presumed that, as it produces an eruption of the skin and dryness of the throat, like that of scarlet fever, it is therefore antidotal. Whether or not belladonna does have such an effect can only be determined by experience, and latterly, as observations accumulate, the number does not seem to increase of those who believe in its prophylactic power. Still, there is difference of opinion among good observers. The difficulty of determining positively the matter of prophylaxis is apparent, when we consider that many children who are exposed to scarlet fever do not take it, although nothing is done for the purpose of prevention. Barnett made use of the following prescription as a preventive:—

R.—Ext. bellad. gr. j)
Aq. rosarum ℥j).
Mise.

Two to three drops were given morning and evening to a child of one year, and one drop more for every year, for children of a more advanced age. He administered it to 120 infants, of whom only five contracted the disease. Schenck, half a century since, stated that, in the course of an epidemic, out of 525 persons who took belladonna only three contracted the disease. M. Biett, whose observations were made during the epidemic prevalence of scarlet fever in Switzerland, states that those to whom belladonna was given usually escaped. On the other hand, Lehmann and Wagner may be mentioned among others on the continent, who believe that they have derived no benefit from the use of this medicine. These physicians have seen one-fourth to one-third of those, to whom belladonna had been given take scarlet fever. In this country, observers differ in their estimate of the preventive effect of belladonna. Dr. Irwin, of South Carolina, as quoted by Dr. Condie, gave it to 250 children, and less than half a dozen took the affection. He employed a solution of three grains of the extract in an ounce of cinnamon water, giving two or three drops to a child under the age of one year, and one additional drop for

each year. Dr. Condie himself, however, has had a different experience. He has prescribed belladonna, "but, although redness and dryness of the throat, and a diffuse scarlet efflorescence were produced in the majority of cases, we never," says he, "found it in any to exert the slightest influence in mitigating the character, or preventing the occurrence of scarlatina. The experiments were made during the prevalence of the disease, and in numerous instances the subjects of them were attacked. In one case the efflorescence was kept up by the use of belladonna forty-eight hours. In a week afterwards this individual took the disease in its most violent form, and died on the fourth day." My observations in reference to this use of belladonna are few, and they are not at all favorable to its employment. I have known scarlet fever occur without apparently any modification, though belladonna was administered daily. Those who have made trial of this medicine have administered it in very different doses. Hahnemann employed it in so small a dose, that it would seem a *prius* that it could have had no effect. Hufeland employed the following formula:—

R.—Ext. bellad. gr. ij;
 Alcohol 3j;
 Aq. destillat. ℥ss.
 Misc.

Dose, one drop morning and evening for each year of the child's age. So small a dose would certainly do no harm, so that the medicine might be safely tried. Still, if belladonna is at all a prophylactic, it is reasonable to suppose that a larger dose would be more decidedly so.

CHAPTER V.

VARIOLA—VARIOLOID.

VARIOLA, or smallpox, is a specific febrile affection, accompanied by a vesiculo-pustular eruption of the skin. Since the discovery of the protective power of vaccination, it has been shorn of much of its terrors, but it is still the most loathsome

and most dreaded of all the fevers. Two forms of this disease are recognized, depending on the fact, whether there has been previous vaccination. If the patient have been vaccinated at some period in his life, the disease, which is rendered milder in consequence, is designated varioloid. If there have been no vaccination, it is called variola or smallpox. Both forms are identical in nature, the one communicating the other: they differ only in gravity.

Smallpox presents four stages, the initial, or that of invasion; the eruptive, that of desiccation, and lastly that of desquamation. It is called discrete when the pustules remain separated from each other; confluent when they unite. This division is made according to the character of the eruption upon the face and hands. There are parts of the surface, as the abdomen, where the pustules are always discrete, even in the confluent form.

INCUBATIVE PERIOD.—During the last half of the last century inoculation with variolous matter was extensively practised in Great Britain and on the Continent, as it was found that smallpox thus communicated was milder than when received by infection. This operation enabled physicians to determine the period of incubation of this disease, which was found to be from eight to eleven days. When variola is communicated by infection the incubative period is somewhat longer, namely, from twelve to fourteen days.

STAGE OF INVASION.—Smallpox begins abruptly with chilliness. In children of an advanced age, there is often, as in the adult, a distinct chill. This is followed by fever, and such symptoms as usually accompany febrile movement, namely, lassitude, anorexia, and thirst. There are, in addition, symptoms, which though not peculiar to smallpox, are so marked in the commencement of this disease, that they possess considerable diagnostic value. These symptoms pertain to the nervous system. There are in most cases of varioloid as well as variola, in the initial stage, severe frontal headache, pain in the small of the back, and great drowsiness, sometimes with delirium. In many children convulsions occur, preceded and followed by a degree of stupor which is almost as profound as coma. Tromsæus suggests the name rachalgia for the pain in the back, as he believes that it is located in, or around the spinal cord. This belief is based on the fact,

which he, as well as other observers, has noticed, that there is sometimes in connection with this symptom an incomplete paraplegia, indicated by numbness of the legs, or even inability to use them, and sometimes more or less paralysis of the bladder. These paraplegic symptoms pass off in a few days. Vomiting is also a common symptom in this stage, and one also of diagnostic value. It occurs at short intervals for twenty-four to thirty-six hours. The same symptom is common in scarlet fever, and not infrequent in measles, but in both these affections irritability of stomach is much less persistent than in smallpox; vomiting does not occur in normal rubeolous and scarlatinous cases more than once or twice.

The tongue is covered with a moist fur. If the disease is to be discrete, constipation is commonly present in the stage of invasion; if confluent, diarrhoea is a common symptom, continuing till the fourth or fifth day, or even longer. Roseola or erythema sometimes occurs in this stage, and this may lead to error of diagnosis, the disease being mistaken for one of these cutaneous affections, or even for scarlet fever. The symptoms in the stage of invasion are usually more violent in confluent than in discrete variola, but there are exceptions.

STAGE OF ERUPTION.—The eruption commences about the third day, earlier in some cases, later in others. The average duration, therefore, of the first stage is somewhat shorter than in measles, but considerably longer than in scarlet fever. Sydenham has stated, and observations show the truth of the remark, that the shorter the first stage, the more severe the disease will prove to be, and, conversely, the longer the period, the milder will be its form. Therefore, if the eruption begins on the second day it will as a rule be confluent, if not till the fifth or sixth day, it will be scanty, and the disease light.

The eruption commences in minute red points, somewhat like those of lichen, which gradually enlarge. It is first observed around the lips and upon the neck, then upon the face, scalp, upper part of chest, arms, and finally, upon the lower part of chest, the abdomen and legs. It is sometimes, especially in young children, first observed in the folds of the skin, as about the genitals or in the groin. If the cuticle is irritated, as by a stimulus, the eruption often appears first upon this part of the

surface, and in greater abundance than elsewhere. The eruption commencing in a minute reddish point, as stated above, rapidly enlarges, and soon its central part begins to be indurated and raised. It feels round and hard to the finger, is tender, and its diameter does not ordinarily exceed two lines. This is the papular stage. The papule increases, and become more elevated, and in twenty-four to forty-eight hours from the commencement of the eruptive stage, they become vesicular. On the fifth day of the eruption, or eighth of the disease, the vesicle has attained its full size. Its diameter is then about one-fourth of an inch, and its elevation is two or three lines. Its base is circular and indurated, and it is surrounded by a narrow zone of inflammation indicated by redness, and tenderness of the skin. The peak commonly, as it passes from the papular to the vesicular stage, loses its acuminate form, and becomes depressed in the centre, but in most cases, mixed with the umbilicated vesicles, are some which remain acuminated.

In proportion as the eruption becomes developed in discrete variola, and in varioloid, the symptoms which accompanied the stage of invasion abate; the fever, headache, pain in the back, and thirst cease, and the appetite returns. In the confluent form, the febrile action continues with little abatement.

Simultaneously with the eruption upon the skin, an eruption also occurs upon the buccal and faucial surface, and often upon that of the air passages. It occurs sometimes, also, upon the conjunctiva, producing dangerous ophthalmia, and even ulceration, with loss of sight; and upon the mucous surface of the genital organs. The form which it presents upon mucous surfaces is somewhat different from that upon the skin. There is at first a deposit of fibrin, producing a small, round, grayish spot at the point of eruption—firm, slightly elevated, and covered, if not by the entire mucous membrane, at least by its epithelial layer. Ulceration soon occurs, as in ulcerous stomatitis, and if the patient live, the reparative process succeeds, as in simple ulcers. The eruption upon mucous surfaces increases considerably the suffering of the patient, in consequence of the tenderness of the ulcers; and if its seat be the surface of the larynx, or trachea, it may be the immediate cause of death, especially in young children, by obstructing respiration.

The cutaneous eruption has been traced to the vesicular stage. On or about the fifth day of the eruptive period, or eighth of smallpox, the vesicles gradually change their character, their contents becoming thicker and turbid. At the same time they increase somewhat in size, and the central depression disappears. This is designated the stage of maturation, or of exsperation, though it is known, that the turbidity is due chiefly to another substance than pus. The pock having undergone these changes, is termed the pustule.

In discrete variola, and in varioloid, the fever returns during the pustular stage; or, if the form of the disease is confluent, and the fever has continued, it now becomes more intense. The return of fever, or its increase, is denoted by increased frequency of pulse, elevation of temperature, dryness of skin, anorexia, and thirst. A tendency to constipation remains throughout the disease in varioloid and discrete variola; in the confluent form, diarrhea more frequently occurs, which, if it continue, is an unfavorable prognostic sign.

Other changes occur. The pustules increase somewhat in size, and become more globular. Some of them, when most distended, break through friction of the clothes, or scratching of the child, and their contents escaping, add to the loathsomeness of the disease. There is in the pustular stage more or less redness of the surface between the eruptions, and, except in the mildest cases, there is tumefaction from subcutaneous infiltration. In the confluent form, at this period, the features are often so swollen that the friends would not recognize the patient. The eyelids may be so swollen that the eyes are for a time concealed from view. This redness of the surface is not altogether absent in the vesicular stage, but it increases during the time of maturation, after which it subsides.

STAGE OF DESICCATION.—This immediately succeeds the full development of the pustules. The liquid portion of the contents of the pustules, which are broken, evaporates, leaving a crust. If there is no rupture, the liquid is absorbed, and a scab results, which, though smaller, preserves in a measure the form of the pustule. While the pustule desiccates, the surrounding inflammation rapidly abates. The crusts occur first upon the face, and on other parts in the order in which the eruption appeared. The

odor from the patient, at this time, is peculiar. In the confluent form, especially, it is very offensive, and can be noticed at a distance from the bedside. Biffert and Bartholin call it rancorous and fetid. As desiccation progresses, the symptoms, local and general, abate. The pulse and temperature, if the case is favorable, return to their normal standard. The cough, hoarseness, and thirst disappear, while the appetite returns; the sleep is more tranquil, and the functions, generally, are more regularly performed.

The last stage is that of desquamation; it commences between the eleventh and sixteenth days. The scales, which present a dark or brownish appearance, are successively detached. This period lasts several days; sometimes two or three weeks even elapse before all the crusts separate. In the mean time the patient gradually recovers his health and former strength. After the fall of the crust, the cicatrix underneath presents a reddish appearance. This color gradually fades, and there remains an irregular depression, or pit of a lighter color than the surrounding surface; and if there has been a full development of the eruption, disfiguring the patient for life.

Such is the clinical history of variola, when it is favorable, and its course is regular. The disease is sometimes irregular. In rare instances the eruption occurs almost at the commencement of the disease. The form is then very apt to be confluent. There are irregularities also, in consequence of diarrhoea, hemorrhages, or other complications. I have known the eruption appear, first on the limbs, and last on the trunk and face, and the appearance of the eruption is not always the same. In the senescent and feeble child, it often presents a pale color, with some induration at its base, but without the red areola around it, or with this quite indistinct. In rare instances the vesicles have a reddish color, their contents being tinged with blood. This form of variola is designated hemorrhagic. It indicates a profoundly altered state of the blood. The eruption in this form is of small size, and if the pock is broken, blood comes from it.

VARIOLOID.—The course of varioloid is similar to that of variola, but it is somewhat shorter. It commences with rigors, followed by fever, headache, pain in the loek, vomiting, drowsiness, and sometimes delirium, or even convulsions. The symptoms in the stage of invasion are indeed the same in character, and often,

nearly as severe as in variola. With the initial symptoms, there is also, sometimes, a scarlatiniform eruption, so that the disease may, at first, be mistaken for scarlatina. On the third or fourth day the variolous eruption commences. The number of pocks is commonly few, often not more than twelve to twenty. In the mildest form of varioloid, if the physician is not summoned in the stage of invasion, he is not apt to be called at all, so that the patient may pass through the disease in ignorance of its nature. I have known this occur, the true character of the affection not being ascertained till others were affected, either with variola or varioloid.

The eruption pursues a more rapid course in varioloid, than in the unmodified disease. By the fifth or sixth day the pustules are fully developed, though often smaller and less likely to be ruptured than in variola. Often, in varioloid, the eruption aborts. It remains papular, two or three days, and then declines, or it may reach the vesicular stage, and decline without pustulation.

The constitutional symptoms in varioloid decline with the commencement of the eruptive stage. The secondary fever is slight or absent.

Such is the usual mild course of varioloid, but not always. If several years have elapsed since the vaccination, its protective power is greatly impaired, and varioloid may then exhibit as severe a form as ordinary smallpox. In some instances it is fatal.

The term varioloid is, as has been stated, applied to cases of variolous disease where there has been previous vaccination. It is also applied by writers to second attacks, whether the first occurred from infection, or from variolous inoculation, but such cases are rare.

MODE OF DEATH.—Death in smallpox occurs in several different ways. The most fatal period is the pustular stage. Feeble children not unfrequently die from exhaustion, at or about the time that the pustules attain their greatest size. The eruption appears and becomes developed as usual, but there are evidences of weakness in the patient, and suddenly the progress of the vesicle or pustule ceases. It begins to subside and its walls shrivel. There is evidently absorption, in part, of the liquid contents. These phaeo-

more are of the gravest character. Death is the common result, and within twenty-four hours. In other cases death occurs from apnoea. The poek increasing in size in the larynx and trachea obstructs inspiration, or there may be the formation of a pseudo-membrane, as in true croup. This is not an unusual mode of death in young children, in whom the calibre of the larynx and trachea is small. Sometimes convulsions and coma occur in the last hours of life. In other cases, the stage of desquamation is reached, but convalescence does not occur. The patient each day becomes more anæmic and feeble, and finally death results from failure of the vital powers. Again, after smallpox has run its course, a purpuric state may be developed. Hemorrhages occur from the gums, throat, nostrils. Blood is vomited, and evacuated in the stools. I have known death to occur in all these ways, but that from purpura is least frequent. Sometimes, as in scarlet fever, death occurs suddenly and unexpectedly, in confluent, and even in discrete variola when the previous symptoms had apparently been favorable. The patient is overpowered by the intensity of the virus.

ANATOMICAL CHARACTERS.—In those who have died of variola, without inflammatory or other complication, the heart clots have been found small, dark, and soft. The blood is dark and thin. The vessels of the brain and its membranes are injected, so that numerous red points appear on the cut surface of this organ. The vessels of the lungs and the abdominal organs are congested, while the muscles present a deep red color. The variolous eruption penetrates more deeply than that of any other exanthematic fever. It has been stated elsewhere that it occurs not only on the skin, but often on the surface of the mouth, fauces, and air passages. The mucous membrane in these situations is frequently also the seat of erythematous inflammation, being thickened and softened, and in some parts, as the larynx, a pseudo-membrane is occasionally produced, as in croup. This inflammation, erythematous or pseudo-membranous, may occur without, as well as with the presence of the specific eruption.

The eruption very seldom, perhaps never, appears upon the gastrointestinal surface, but the solitary follicles and patches of Peyer are often enlarged, as in some other zymotic affections. The liver, spleen, and kidneys are commonly congested in those

who have died of variola. The spleen, especially, is increased in volume and softened; the kidneys are enlarged as if from commencing nephritis, and sometimes softened.

The minute structure of the pock is described by Rilliet and Barthlin, and others. The vesicle is multilocular, consisting of at least five or six compartments, with distinct partitions. Its centre is united by fibrinous bands to the derm beneath, which union gives rise to the umbilicated appearance. The giving way of these minute bands in the pustular stage occurs when the form changes from the umbilicated to the convex. In the pustular stage also, according to some, a fibrinous formation occurs within the pustule; according to others, this substance is of the nature of the epidermis, presenting the appearance of the cuticle when macerated. Mixed with this epidermic or fibrinous formation are pus cells.

COMPLICATIONS.—There are several different complications of variola. One is salivation. This is common in the adult, but rare in the child. When it occurs in the child, it is slight, commencing with, or about the time of the eruption, and disappearing in from one to four or five days. Ophthalmia is another complication. Simple conjunctivitis, often quite intense, may occur in consequence of pustules developed under the lids. This inflammation subsides without injury to the eye, as the primary disease abates. A more serious inflammation occurs at an advanced stage of the disease, commencing in or near the desquamative period. This produces more or less chemosis, and sometimes opacity, or ulceration of the cornea. A similar inflammation may occur in the ear, giving rise to otorrhea, and even in some patients to rupture of the drum of the ear. Abscesses in the subcutaneous cellular tissue have been occasionally observed, especially in the confluent form. Subcutaneous infiltration and feebleness of constitution favor their occurrence. Suppuration within the joints is a somewhat rare complication, or sequel, rendering convalescence protracted, if, indeed, the case is not fatal.

M. Bérard has published a memoir to show that proctitis complicates variola in the male, and ovaritis in the female. These inflammations are believed to be accompanied by a small and imperfect variolous eruption upon the tunica vaginalis and the peritoneal covering of the ovary. Trousseau states that he has

often met this complication in the male, since his attention was called to it. It is mild, and subsides with the disappearance of the eruption. Laryngitis, simple or diphtheritic, bronchitis, pneumonia, pharyngitis, purpuric hemorrhages, gangrene of the mouth or other parts, oedema pulmonum and oedema glottidis are occasional complications, some of which are frequent, others rare.

PROGNOSIS.—This depends on the age, vigor of system, form of the disease, and the presence or absence of complications. The younger the child, the greater the danger. *Trousseau* says: "Confluent variola, and even discrete variola, are almost always fatal in individuals less than two years old." Above the age of three or four years discrete variola usually ends favorably, but the confluent form is still, as a rule, fatal. Varioloid in the child is a mild disease, terminating favorably in a large proportion of cases. It is milder at this age than in the adult, on account of the more recent period of vaccination, and if a case of supposed varioloid is severe, and the eruption abundant, it is probable that the vaccination was spurious.

It is not necessary, from what has been said, to specify the favorable prognosis signs. The unfavorable prognostics are, great violence of the initial symptoms; early appearance of the eruption; an abundant eruption, especially if pale, and without swelling of the surface; rapid decline of the eruption in the vesicular or pustular stage; hemorrhagic eruption, or hemorrhages from the surfaces; fever continuing after the appearance of the eruption; diarrhoea persisting beyond the third or fourth day; delirium, or great drowsiness; a frequent and feeble pulse; and finally, obstructed respiration—if slow, indicating a pseudo-membrane or variolous eruption in the larynx or trachea—if rapid, indicating bronchitis or pneumonia.

DIAGNOSIS.—The diagnosis cannot be made with certainty prior to the eruptive stage. If, however, smallpox is prevalent; if the patient has not been vaccinated, and the symptoms which pertain to the period of invasion are present, as headache, pain in small of back, repeated vomiting, drowsiness, and perhaps convulsions, there is ground for the gravest suspicion. If, in addition to these symptoms, reddish points begin to appear on the second or third day, the diagnosis may be made with con-

vidence. At this early period, even before there is any distinct cutaneous eruption, ash-colored spots may sometimes be observed on the buccal or faucial surface, the commencement of the variolous eruption; these possess considerable diagnostic value.

The scarlatiniform efflorescence, in the first stage of variola, sometimes leads to the belief that the disease is scarlet fever. The absence of the pharyngitis, and the appearance of the variolous eruption soon after the efflorescence, correct the diagnosis. Smallpox has, in the beginning of the eruptive period, sometimes been mistaken for measles. The points involved in the differential diagnosis have been presented, in treating of that disease. After the development of the eruption it may be mistaken for varicella. The eruption of varicella is, however, preceded by symptoms which are milder and of shorter duration, and its appearance is different. It is irregular, instead of round; is not umbilicated, and it does not have the round, inflamed, and indurated base, which characterizes the variolous eruption. The eruption of ecthyma is sometimes umbilicated, but the symptoms of ecthyma and variola, and the progress of the eruptions in the two diseases are very different.

TREATMENT.—Smallpox, like the other essential fevers, is self-limited, and therefore the constitutional treatment should be palliative and expectant. In the first stages of the disease, the diet should be simple; gentle laxatives and refrigerant drinks are required, if there is much febrile excitement. Lemonade is a grateful drink, and may be given in moderate quantity. Spiritus Mindereri, or carbonic acid water, may be allowed. As the disease advances, more nutritious food should be recommended; and in certain cases carbonate of ammonia, and even alcoholic stimulants, are required.

As confluent smallpox is nearly always, and the discrete form often, fatal in infancy, the physician should carefully watch the progress of the case in the infant. By judicious treatment some, in this period of life, may be saved, who otherwise would perish. In the infant, depressing measures should be avoided. A laxative may be given, at first, if there is much fever, and the bowels are constipated; but the diet should be nutritious, and many soon require tonics and stimulants. If the pulse become more frequent and feeble, or if, with frequency of the pulse, the face and extremities become cool, or if in the vesicular or pustular

stage, the eruption suddenly subsides, alcoholic stimulants must be immediately employed, or the patient dies.

Such is an outline of the constitutional treatment required in smallpox. Sydenham breasted a mode of treatment which experience has shown to be injurious in infancy and childhood. He had observed that the severity of the disease was ordinarily proportionate to the amount of eruption, and concluded from this fact that measures which retarded the development of the eruption were salutary—cold drinks, a cool apartment, scanty covering of the body, cathartics that caused derivation of blood from the surface—even sometimes the abstraction of blood—were considered, according to Sydenham's theory, to be useful as means of preventing full development of the eruption.

Sydenham's treatment, however appropriate it might sometimes be in case of robust adults, is unsuitable for children, because they do not, as a rule, tolerate, in this disease, measures which reduce the strength. Moreover, smallpox is rendered more dangerous by what Billiet and Barthex designate *perturbating treatment*—treatment which renders it abnormal. The regular appearance and development of the eruption are requisite in order that the case may progress favorably. On the other hand, the opposite plan of treatment, which families, if left to themselves, are apt to adopt—namely, the employment of measures to promote perspiration, as hot drinks, and confinement in a heated room—is also injurious.

The patient should be kept in a temperature such as he has been accustomed to, and such as is agreeable to him; his diet should be simple and nutritious; laxative medicine should only be given to procure the natural evacuations. In smallpox, as in all zymotic diseases, free ventilation of the apartment is required.

While the general eruption in smallpox should not be interfered with, it is proper to endeavor to diminish, so far as possible, the size of the pocks, on parts exposed to view, and to prevent disfigurement. Prof. Flint, in his *Treatise on the Practice of Medicine*, has published an excellent summary of the various measures which have been recommended for accomplishing this end. First: The opening and breaking up of the vesicle by means of a fine needle. This is tedious practice in confluent variola, but it can readily be performed in the discrete form—at least as regards the vesicles upon the face. This treatment was

proposed by Rayer, and it is recommended by many who have tried it. Secondly: After the evacuation of the liquid the cauterization of the vesicle by a pointed stick of nitrate of silver. Rilliet and Barthex say, in reference to this mode of treatment, "Individual cauterization of the pustules is, on the other hand, an almost infallible means of causing them to abort. To be successful, it is necessary to penetrate into the interior of the pustule with a pointed crayon of nitrate of silver, in order to cauterize the derm. . . . It is only the first or second day of the eruption that it (cauterization) has certain success; nevertheless we have often seen it succeed the third or the fourth day, or even the fifth."

Thirdly: The application of tincture of iodine once or twice daily over the eruption when in the papular stage. Some writers, who have employed iodine, state that it does not prevent pitting, but diminishes it. Fourthly: The exclusion of light and air by means of a plaster. A mixture containing tannate of iron has been employed for this purpose in one of our hospitals. This produces a black mask. Light and air may also be excluded by smearing the face with sweet oil, and dusting twice daily upon the oiled surface a powder containing equal parts of subnitrate of bismuth and prepared chalk. Fifthly: The application of mild mercurial ointment upon the face or other parts of the surface, where it is desirable to render the eruption abortive. This mode of treatment does diminish the size of the vesicles and the pitting, but I should not recommend it for children. I have known in the adult severe mercurialization from its employment for four or five days, and, though young children do not exhibit so readily the effects of mercury, the use of the ointment, unless for a very limited period, increases, in my opinion, their feebleness, and diminishes the chance of their recovery. Calamine made into a paste with sweet oil is said to be equally effectual with mercurial ointment, and it produces no constitutional effect. Its effect is obviously similar to that of the bismuth and chalk employed with sweet oil as stated above. Various other substances have been recommended for application, in order to prevent disfigurement, but no one appears to possess advantages over those already recommended. Poultices, collodion, a solution of gutta serena in chloroform, have been recommended, among other substances, by good observers. If fissures or excoriations occur, an applica-

tion may be made of oxide, or carbonate of zinc in glycerine, one drachm to the ounce.

The prevention of smallpox, so far as practicable, is one of the important incidental duties of the physician. Isolation of the patient, and precautions in reference to his clothes and bedding, are imperatively required, so great is the infectiousness of this disease. The only certain means of prevention is confessedly vaccination, and providentially the incubative period of the vaccine disease is much less than that of variola. Therefore, smallpox may be prevented after the virus is received in the system, by timely and successful vaccination. Vaccination, at any period between the time of exposure and the commencement of the symptoms of invasion, will either prevent the occurrence of smallpox or modify it. If the symptoms of invasion have already commenced, it is uncertain whether it produces any modifying effect.

CHAPTER VI.

VACCINIA.

VACCINIA is a mild eruptive disease, which occasionally occurs among cattle, and has been propagated from them to man. It is characterized by the appearance upon the surface of one or more papules, which soon become vesicular, and then pustular. It is zymotic, and inoculable, but, unlike the other zymotic diseases, it is not infectious in man. It is inoculable, both by the liquid contained in the vesicle, which is designated vaccine lymph, and by the scab, which results from the desiccation of the pustule.

To Gloucestershire, England, the honor belongs of discovering and popularizing the fact that vaccinia, a mild and comparatively harmless disease, is transmissible from the cow to man, and that it affords protection from smallpox. It appears that a vague opinion prevailed among the farmers of this dairying section, that a disease, which has since been designated vaccinia, was occasionally received from the cow in milking, the virus passing from a pustule on the teat to a sore, or chaf on the hand of the milker, and that those who thus contracted the disease receive immunity

from smallpox. As usually happens with important discoveries, so dull of apprehension is human intellect, these people, to whom Providence has revealed so important a fact, were blind to its real value. Finally, in the year 1774, Benjamin Jesty, whom the world has not sufficiently honored, "an honest and upright man," according to his epitaph, a farmer of Gloucestershire, had the courage to vaccinate his wife and two children. His excellent moral character did not shield him. He was regarded by his neighbors as an inhuman brute, who had performed an experiment on his own family, the tendency of which might be to transform them into beasts with horns.

This first essay in vaccination appears to have been entirely successful, but the prejudice against the operation continued. A fifth of a century passed, during which there was no extension of the benefits of this great discovery. At last, towards the close of the last century, Dr. Edward Jenner, a physician of Gloucestershire, and inoculator of his district, began to investigate this disease of the cow, about which little was known, and the grounds for the belief that it afforded protection from smallpox. Fortunately for the world, Jenner had been educated at the feet of John Hunter, and had learned from his great master to study nature rather than books, to be guided by experience and observations, rather than by the dogmas of his predecessors or of the schools.

Jenner performed his first vaccination on the 14th of May, 1796, twenty-two years after Benjamin Jesty had lost his good name among his neighbors, for vaccinating his own family. The popularizing of vaccination, mainly through Jenner's perseverance, affords one of the most interesting and instructive chapters in the history of medical science. How he went up to London, full of the importance of the discovery, and was there advised by his medical friends to desist from his wild schemes, lest he should injure the reputation which he had gained by publishing a creditable paper on the cuckoo; how he was allowed to vaccinate in the hospital wards, and gained some adherents to the new faith among the leading physicians of the metropolis, and finally, how, as the claims of vaccination began to be recognized, at the close of the last century, and commencement of the present, a most acrimonious discussion arose, which filled all the medical journals of that period. The opponents of vaccination resorted to every device to prevent the acceptance of Jenner's views. They at-

tempted to prejudice the people against them by specious arguments, by ridicule, and even by pictures. One of the leading journals contained the caricature of a cow covered with sores, and devouring children, and it was urged that vaccination was a bestial operation, degrading man to the level of the brute. But the truth had gained too firm a hold, and opposition to it finally ceased.

The discovery of vaccinia, and of its protective power, cannot be too highly appreciated. It has done more to relieve human suffering, probably, than any other discovery of the last one hundred years, unless we except that of anesthetics, and probably more to save human life, than any other instrumentality of a purely physical kind.

The fact was established in the time of Jenner that the virus of smallpox inoculated in the cow produced vaccinia, which in its propagation back to man never returned to its original form, but always remained vaccinia. Moreover, Jenner believed that the disease known in the horse as the grease was identical in nature with vaccinia in the cow. He failed, however, in his experiments to communicate vaccinia from the horse, but other experimenters have been more successful. In 1801, a Dr. Loy, of the county of York, England, met two cases of vaccinia in persons who had taken care of a horse affected with the grease, and from the lymph which he obtained, was able to produce vaccinia in the cow. In 1805, Viborg, a Danish veterinary surgeon, after many failures, succeeded also in communicating vaccinia to the cow, by means of the virus taken from a horse.

From this time little light was thrown on this subject till within the last twelve years. Although Loy and Viborg, and perhaps a few others, had recorded their success, other experimenters had failed to communicate vaccinia from the horse. In the absence of additional cases the profession began to question whether there might not have been some error in the observations of the gentlemen, whose names I have mentioned, and the problem was still regarded as undetermined, whether a disease identical with vaccinia occurred in the horse, or a disease which might communicate vaccinia to the cow or to man.

Observations confirmatory of those of Loy and Viborg were at length, however, made, which must be regarded as conclusive. In 1856, in the department d'Eure-et-Loir, France, M. Pichet was

consulted by a boy, who had on the back of his hands vaccine pustules, which had apparently reached the eighth or ninth day. He had not taken care of, nor been in contact with a cow, but had a few days before taken care of a horse affected with the grease. Vaccination was performed by means of the lymph taken from these pustules, and genuine vaccinia was produced.

Again, in 1840, an epidemic prevailed among the horses in Roumes and Toulous, France. A mare was seized with the disease, and there was swelling of the thigh, with discharge of sinuous matter. M. Delafosse vaccinated two cows with this matter, and communicated genuine vaccinia. This epidemic was believed by the veterinary surgeons to be an eruptive fever, differing in its nature somewhat from the disease or diseases which have ordinarily been designated the grease. It has been conjectured that two or more distinct affections of the horse have the same appellation, one of which, it is now admitted, is identical with vaccinia of the cow, and may communicate it. And the reason why so many experimenters have failed to vaccinate the cow from the horse, is that they have used the virus of the wrong disease, or have taken matter from horses which had been affected with the true disease, but from ulcers which had lost their specific character.

Prior to the time of Jenner variolous inoculation was practised in most civilized countries, as variola produced in this way was found to be milder than when arising from infection. This practice is now obsolete; forbidden in some places by legislative enactments. It is superseded by vaccination. Vaccination, or the introduction of vaccine lymph into the system, is quickly and conveniently performed by scarifying with a lancet, and pressing into the incisions the lymph, or a little of the scab pulverized, and dissolved in a drop of cold water. It may also be performed by scraping off the epidermis with the edge of the instrument till the blood begins to ooze, and also, though with less certainty of success, by puncturing the skin with the point of the lancet, or by an instrument called the vaccinator.

If the child have a vascular nevus, this should be selected as the point of vaccination. Unless of large size it can usually be cured by the inflammation which vaccinia produces. Statistics collected by Simon, as well as Marson, show that of those who contract varioloid, the larger the number of vaccine cicatrices

the milder the disease, and the less the proportionate number of deaths. In Simon's statistics of those who stated that they had been vaccinated, but who presented no cicatrix, $21\frac{1}{2}$ per cent. died; of those who had one cicatrix, $7\frac{1}{2}$ per cent. died; of those who had two, $4\frac{1}{2}$ per cent. died; of those who had three, $1\frac{1}{2}$ per cent. died; while of those who had four or more cicatrices, only $\frac{1}{2}$ per cent. died. These statistics would seem to indicate the propriety of vaccinating in several places. But so far as appears, when two or more cicatrices were observed, the patients may have been vaccinated at different times, at intervals, perhaps, of several years, and if so, the inference would not follow that more complete protection is produced by vaccinating in several places than in one. Moreover, if vaccination is performed by incisions, made over a quarter of an inch square, and the virus is fresh and active, usually two or more distinct vesicles arise, which unite in their development and probably protect the system as much as if they were separated by a wider space.

APPEARANCES, SYMPTOMS.—In genuine vaccination no effect is observed, except the slight inflammation due to the operation, till the close of the third day. Then the specific inflammation commences. This is indicated by a small red point, at first scarcely visible, indurated and slightly elevated, as determined by the touch, rather than by the eye. This increases, and on the fifth day the cuticle over the inflamed part begins to be raised by a transparent and thin liquid. The vesicle increases in diameter, and by the sixth day presents an umbilicated appearance, and is surrounded by a faint and narrow red zone. At the close of the eighth day the vesicle is fully developed. Its size varies considerably. It is usually from a sixth to a third of an inch in diameter, and oval or circular. If the vaccination has been performed by incisions, the size of the matured vesicle may be considerably larger, and its shape irregular, in consequence of the union of two or more vesicles. The eruption now presents a whitish or pearl-colored appearance, due to the whiteness of the cuticle, and the transparency of the liquid underneath. If the vaccination were performed by incisions, it is not unusual to observe over the centre of the vesicle, and adhering to it, a small yellowish scab, which has resulted from the scorfication, and which contains none of the virus.

The vaccine vesicle, like that of variola, consists of compart-

ments, commonly eight or ten, with complete partitions, so that there is no inter-communication. On the ninth day the inflamed areola becomes more distinct, and its diameter rapidly increases. Its color is deep red, its temperature is considerably elevated, and it is accompanied by more or less induration of the subcutaneous tissue, and it is tender to the touch. On the tenth day the pock has reached its full development. The areola, then, extends from one to two inches away from the vesicle, becoming fainter at its outer circumference, and gradually disappearing in the healthy skin. The shape of the outer circumference of the areola is irregular, projecting farther at one point than another, though its general form is circular.

On the tenth day, when the inflammation has reached its maximum, the heat, itching, and tenderness in, and around the pock, are such, that the child is often feverish and restless. Occasionally, the glands of the axilla become swollen and tender. In other cases, in which there is but a moderate amount of inflammation, the constitutional disturbance is slight.

At the close of the tenth day, or in the eleventh, the inflammation begins to decline; the areola becomes narrower and then disappears; the induration and tenderness abate, and with this change the pustule desiccates, its liquid is absorbed, and there results a brownish or a dark mahogany-colored scab, which is detached, ordinarily, between the fourteenth and twenty-first days. The cicatrix, at first reddish, like all recent cicatrices, gradually becomes paler, and remains whiter than the surrounding integument. It presents several minute depressions or pits, which indicate the genuineness of the vaccination.

ANOMALIES, COMPLICATIONS, AND SEQUELS.—The vesicle is often broken, accidentally, or by the nails of the child. If the top of the vesicle is destroyed, or most of the compartments are opened, the inflammation is commonly increased, considerable suppuration occurs, and there results a large, irregular, yellowish scab, consisting of the virus mixed with desiccated pus. This scab is entirely unreliable, and unfit for the purpose of vaccination, though the protective power of the disease is not diminished by injury of the vesicle, even if it is totally destroyed. The cicatrix, which results from extensive injury of the vesicle, is apt to be large, and without the indented points, which characterize the normal cicatrix.

In rare cases, when the inflammation which surrounds the vesicle is intense and deep-seated, suppuration occurs in the subjacent cellular tissue, giving rise to an abscess. This abscess is commonly of small size, but it increases the fretfulness and constitutional disturbance which attend vaccinia. This subcutaneous suppuration is believed to occur most frequently in those who have a scrofulous or vitiated state of system. Inflammation of the lymphatic glands of the axilla I have spoken of as not infrequent in vaccinia. This sometimes proceeds to suppuration, producing an unpleasant, though not serious complication.

It sometimes happens that vesicles appear in other parts besides the points where the virus was inserted. These super-numerary vesicles commonly occur where the cuticle has been removed by scalds or injuries.

Trousseau relates the case of an infant, whom he had vaccinated. On the eleventh day he was astonished to find twenty-seven vaccine pustules on the face, trunk, and limbs. This infant had, however, before the vaccination, a simple non-specific eruption over the whole body, and it was believed that it had produced these vaccinations by transferring the lymph, with its milt, to the various parts, where the cuticle was denuded.

It is not unusual, also, to observe minute papules appearing on parts of the surface simultaneously with, or soon after the vesicle, and in a few days declining. These seem to be abortive vaccine eruptions.

One of the most serious complications is erysipelas. This may occur directly from the operation, or from the inflammation caused by the vesicle, when the virus possesses no deleterious property, and again it may result from some unknown element in the virus. It may occur immediately after the operation, when it commonly prevents the working of the virus, or during the vesicular or pustular stage; or again after desiccation and separation of the scab. I have observed it commencing at all these periods.

Erysipelas, occurring as a complication of vaccinia, is invariably referred by the friends to the virus employed, and the physician who has had the misfortune to vaccinate is often unjustly blamed. In many of these cases there was a strong predisposition to erysipelas at the time of the vaccination, and the operation, or the inflammation which accompanied the normal development

of the vesicle, served simply as an exciting cause. Erysipelas would occur as soon from a non-specific sore; indeed, we not unfrequently are called to cases of this disease in young children, which commenced from non-specific sores upon the genitals, or one of the limbs. That the fault is not in the virus employed, is evident from the fact that other children, vaccinated with the same, have simple uncomplicated vaccinia.

Sometimes, on the other hand, the cause of erysipelas, whatever it may be, exists in the virus. For further facts in reference to this subject the reader is referred to our remarks on erysipelas.

The fact is established by many observations that syphilis is communicable by vaccination. The symptoms of it may not appear till vaccinia has terminated, or for a little time subsequently, but it then constitutes a very serious sequel. A physician of this city, well known in this community as skillful in the diagnosis and treatment of skin diseases, and therefore not likely to be mistaken as regards the nature of the disease, states that he communicated syphilis to two infants by vaccinating with the same scab. Both had the characteristic syphilitic eruption. Recently (January, 1868) an infant was brought to Prof. Alonzo Clark's clinic, in this city, having syphilitic rupia, which, in the opinion of the physicians present, was undoubtedly the result of vaccination.

Trousseau relates the case of a young woman, eighteen years old, who was vaccinated with virus taken from an infant apparently in perfect health. The vaccination was unsuccessful; but twenty-three days subsequently his attention was called to an eruption, which had appeared in two places on the woman's arm, corresponding with the points where the virus had been inserted. The eruption was that of cothyma, which, by the next examination, which was five days subsequently, had been transformed into rupia. The axillary lymphatic glands were tumefied and indolent, and, finally, roseola appeared, which removed all doubt as to the syphilitic character of the disease. There was syphilitic infection, which first manifested itself in the points where vaccination had been performed (*Article de la Vaccine*). It is not ascertained in Prof. Clark's case, nor is it stated in Trousseau's, whether the lymph or scab was employed for vaccination; but it is probable that the danger of syphilitic infection is much greater

from the seal than from the lymph, on account of the amount of animal matter, which it contains.

The vesicle, in genuine vaccinia, is sometimes very small, not having a diameter of more than two lines. Occasionally, the development of the vesicle is retarded. It does not appear till two or three days later than the usual time, or even a longer period.

Vaccinia is modified by certain diseases. It is arrested by measles and scarlet fever, pursuing its course after the subsidence of the exanthema. On the other hand, it arrests the paroxysmal cough of pertussis, which returns when the pox begins to abate. Erythematous eruptions sometimes occur after vaccinia, as they often do after the other eruptive fevers; or, if already present, they may be aggravated.

Subsequent Vaccinations.

A second vaccination, performed prior to the ninth day after the first vaccination, is successful. A genuine vaccine eruption results, which is smaller the more advanced the primary disease. This second eruption overtakes the first. On the ninth day the susceptibility to vaccinia is, in most cases, lost; so that vaccination performed on the tenth, or subsequent days, is unsuccessful.

As a rule, a zymotic disease occurs only once in the same individual. Vaccinia is an exception. In most cases, after a few years, it can be produced a second time; and cases of a third or fourth successful vaccination, at intervals of a few years, are not uncommon. Now, subsequent cases of vaccinia differ from the first, which has been described above. The period of incubation is shorter, and the vesicular, pustular, and desquamative stages succeed each other more rapidly, so that the whole period of the disease is less. The variation from the appearance and course of the first vesicle, is proportionate to the degree of protection, which the first vaccination still affords, both as regards smallpox and vaccinia. If several years have elapsed since the first vaccination, and the protective power, which it afforded, is nearly lost, the second vaccinia differs but little from the first. If, on the other hand, the first vaccination still affords nearly complete protection, the result of the second is slight; the eruption is insignificant, lacking the characteristic appearance of the

vaccine vesicle, resembling a common sore, and disappearing within a week. It is accompanied by no inflamed areola, and by no constitutional disturbance.

Vaccination often produces no result. This is sometimes due to the fact that the lymph or scab employed is useless. It has spoiled by keeping, or never has been good. In other cases, it is due to a lack of susceptibility in the person. Some take vaccine with difficulty, and only after several vaccinations; just as children, though fully exposed, often fail to take measles or scarlet fever, on account of a condition of the system which prevents the reception of the virus, or antagonizes and controls its action. In some instances, after vaccination, an eruption is produced, which may or may not be genuine; but it immediately becomes purulent, and is soon broken. A large, yellow, uneven scab results, having none of the appearance, and containing little, or none, of the vaccine virus. This scab, as well as the liquid matter which preceded the formation of the scab, is utterly useless for the purpose of vaccination, and, if so employed, will probably cause a sore from its irritating effect, but not of a specific character. If, in place of the true vaccine vesicle, the eruption presents the appearance which I have described, namely, that of a pustule, soon breaking, and forming a large, irregular, yellowish scab, the vaccine—if it is correct so to designate it—must be considered spurious. A sore has been produced by the animal matter which was employed in vaccination along with the virus, which has modified the action of the virus, and probably has rendered it useless as a means of protection; or there may have been no virus inserted with this animal matter. The physician should in such cases insist on a second vaccination.

Cases, like the above, are of frequent occurrence, and the parents of the child are often satisfied with the result. They see an eruption following the vaccination, accompanied by considerable inflammation, and leaving a cicatrix. Unless undeceived by the physician, they are apt to remain in the belief of the child's security, until, perhaps, it takes smallpox. Such cases, obviously, tend to diminish the confidence which the public should have in vaccination, as a means of protection from smallpox, and on account of their frequent occurrence, it is important in all cases that the physician should see the result of his vaccination. It has been proposed, as a means of determining the genuineness of the

vaccinia, to revaccinate when the eruption begins, and if the first be passing the second will overtake it. This is called Brier's test, but it is not necessary, since the physician, familiar with the appearance of the true vesicle, can determine at once its genuineness by the sight.

Protection from Vaccination—Revaccination.

It was believed by the early advocates of vaccination, that the general performance of this operation would soon eradicate smallpox from the community, so that it would be regarded as a disease of the past, rather than of the present time. This result, however, is not achieved. As a rule, the greater the benefit of any measure designed to ameliorate the condition of mankind, the greater and more numerous are the obstacles which diminish its effectiveness. Science is full of examples of this. Fortunately these obstacles, as regards vaccination, are not such as to impair the confidence of physicians in its protective power, and it is not too much to expect that this simple operation will yet be the means of rendering smallpox a disease almost unknown, unless in its modified form.

Vaccination should be performed in the first year of life. In the country, where there is little danger of exposure to smallpox, it may be deferred till the age of ten or twelve months. In the city, on the other hand, where there is constant intercourse of people, and where contagious diseases are often contracted without its being known when exposure occurred, an earlier vaccination is advisable. Some physicians recommend performance of the operation as early as the age of four to six weeks. The objection to this is that if erysipelas occur, so young an infant is apt to perish from it, whereas an infant three or four months old ordinarily recovers. For this reason I believe that the most suitable age is about four months for the city infant, in ordinary times, but, if smallpox is epidemic, vaccination should be performed at an earlier age. I have vaccinated even the new-born infant when smallpox had broken out in adjoining apartments.

Vaccinia usually extinguishes, for a time, the susceptibility to smallpox. According to M. Gintree, varioloid does not occur within two years, in those who have been vaccinated. It may, however, in exceptional instances, occur in a mild form within a

few months after vaccination. The protection afforded by vaccinia gradually diminishes by time, but it does not, probably, as a rule, cease entirely. Varioloid, however, occurring thirty or forty years after a successful vaccination, is apt to be severe, and it may even be fatal, showing that it has been but slightly modified. In other cases, even after so long an interval, the symptoms present a degree of mildness, which indicates that the protective power of the vaccination is not entirely lost.

If a second vaccination is practised soon after the scab from the first vaccination has fallen, it will usually produce no result, but in other cases it gives rise to a little redness, swelling, and induration, which show that vaccinia has been reproduced, though in a very mild and insignificant form. It is probable that in these cases varioloid might also occur by exposure, though with a mildness corresponding with that of the vaccinia. The longer the period after the first vaccination, the greater the number of those in whom a second vaccination is effective, and, as has already been intimated, the greater also the liability to the variolous disease if a second vaccination is not performed. It is recommended, therefore, to perform a second vaccination, not later than the sixth or eighth year, and again in childhood. And if smallpox is epidemic, it is proper to vaccinate all who have not been vaccinated within three or four years.

Selection of Virus.

The lymph is preferable to the scab for vaccination, provided that it can be obtained fresh. The scab is more easily preserved, and, therefore, if the lymph and scab are old, the latter is to be preferred. The lymph should, if the vesicle is sufficiently developed, be taken on the fifth day. It may also be taken on the sixth, seventh, or even eighth day, provided that the areola has not formed. The lymph of the fifth day acts with greater energy, though that of the sixth or seventh day is not much inferior. Lymph obtained after the formation of the areola is less efficient, though it may communicate the genuine disease.

There is no mode of vaccination so reliable as the use of lymph, taken directly from the arm and immediately inserted—the arm to arm vaccination. Lymph can be preserved for a few days on a flattened surface of whalebone, or the segment of a quill; the

former I prefer, and if employed within a week, it will usually communicate vaccinia. Lymph may be preserved a longer period between two surfaces of glass, but the best way of preserving it is in capillary glass tubes. The end of the tube is placed within the vesicle and the lymph ascends by capillary attraction. When a sufficient quantity is received, the ends are sealed, by holding them for a moment in a flame. Care is requisite in doing this, so as not to heat the lymph, as it is spoiled by a temperature much above the body. When the lymph is used, the ends of the tube are broken, and by blowing gently through it, a sufficient quantity is received on the point of a lancet.

If the scab is genuine, it presents a dark-brown or mahogany color, and has a circular, oval, or at least a rounded form; it is firm, or compact, and has a lustre. Soft, yellowish, and irregular scabs, are not genuine, and those of a dull appearance, or without lustre, have usually spoiled in the keeping. It is the belief of many, that the vaccine virus gradually becomes weaker by passing successively through the human system (Condie, *American Journal of the Medical Sciences*, April, 1865), and that therefore different specimens of virus work with different energy, according to the degree of removal from the cow. To what extent this view is correct is not fully ascertained, but, certainly, if the virus employed continues to produce a small vesicle, and attended only by little inflammation, there is reason to believe that the protection which it imparts is less than that from virus which works with greater energy, and it should be exchanged for such. The scab is best preserved in soft beeswax, which excludes the air, and it should be kept in a cool place.

CHAPTER VII.

VARICELLA.

VARICELLA, chickenpox or swinepox, is the shortest and mildest of the eruptive fevers. It is highly infectious, so that few children escape who are exposed to it. Its period of incubation is from fifteen to seventeen days. It is not inoculable, or at least

those who have attempted to inoculate with the lymph of varicella have failed. I endeavored to communicate the disease in this way some years ago, but without result. It attacks the same individual but once, and it occurs as an epidemic. It has been thought by some to prevail most, immediately before, during, or after epidemics of smallpox, and it has been conjectured that it is a modified form of variola, and hence its name, which signifies little variola. This idea is, however, entertained by few, and it is opposed by the following facts. Varicella may occur after variola or variola after varicella, without any modification, and the two diseases are very dissimilar as regards gravity of symptoms and duration. The variolous disease, whether smallpox or varioloid, often occurs in the adult; varicella, on the other hand, is a disease of infancy and childhood. Professor Flint states that he has observed it in the adult, but its occurrence at this period of life is rare. Moreover varicella and variola have been known to occur simultaneously in the same individual. Such a case was reported by M. Delpech, in a memoir published in 1845.

SYMPTOMS.—Varicella usually commences with such symptoms, as usher in ordinary mild febrile attacks, namely, headache, languor, chilliness, and sometimes itching in the back and limbs. Fever supervenes, which is usually moderate, the pulse rising perhaps to 100 or 112, and the thermometer showing an increase of temperature, but less than occurs in the other eruptive fevers. These symptoms, which precede the eruption, are sometimes absent, or are so mild as to escape notice. The fever usually ceases on the second day, but it may return on the following night. The appetite is rarely lost, and most children continue, more or less, at their amusements.

The eruption commences in about twenty-four hours, appearing as small red points, first over the trunk, and soon afterwards over the face and limbs. These points, which are at first minute papules, become vesicular in the course of a few hours. The occurrence of the vesicular stage is nearly simultaneous on all parts of the surface. The vesicles lack the hard indurated base of the variolous eruption, though they are sometimes surrounded by a faint zone of redness. They differ also from the variolous eruption in the absence of umbilication, and in irregularity of shape. Some are small and acuminate, some hemispherical, and of medium size, and others oval or elongated, and

of large size. The inflammation is quite superficial, not involving the subcutaneous tissue, and scarcely affecting the deepest layer of the skin.

The vesicles vary in size from the diameter of half a line to that of even three lines. They occasionally give rise to slight itching. On the second day of the eruption, or third of the disease, the vesicles are still fully developed, their liquid contents being nearly transparent. At the close of this day the liquid begins to be somewhat cloudy, and its absorption commences. On the fourth day of the disease desiccation progresses rapidly, and by the fifth, the liquid has for the most part disappeared, and there results a scab, small and thin, of a yellowish-brown color. The scabs are soon detached, the redness which indicated their vent disappears, the epiderm, which had been raised and removed by the eruption, is reproduced in its normal state, and in a few days, all evidence of varicella is effaced. A cicatrix occasionally results, but it is due not to the simple varioidar eruption, but to a sore produced from the eruption by the scratching of the child.

The number of vesicles varies considerably in different cases. They are never, so far as I have observed, confluent; but they are sometimes so abundant in young children that, if the disease were variola, it would be called *severe discrete*.

DIAGNOSIS.—Obviously the only diseases with which varioida is liable to be confounded, are such as present vesicles at some stage of their course. From the local vesicular eruptions this disease is diagnosticated by the fact that the vesicles appear on all parts of the surface. It is sometimes mistaken for variola or varioloid, or *vice versa*—a mistake very damaging to the reputation of the physician. The points of differential diagnosis are the symptoms of invasion—severe, and lasting three or four days in the one; mild, and continuing only one day in the other—an eruption passing slowly through its stages from the papule to the pustule, umbilicated, with circular, raised, and inflamed base, appearing first on the face and neck, and not till a day later, on the legs, in the one disease; while, in the other, the evolution, shape, and course of the eruption, as described above, are materially different. By proper attention to these distinctive features it is rarely difficult to diagnosticate the two diseases.

The prognosis in varicella is always favorable. It does not, of itself, endanger life, nor seriously incommode the patient; nor

does it give rise to complications, nor sequela. The TREATMENT, therefore, is the simplest possible. Mild diet, and a laxative, may be prescribed during the febrile period; but nothing farther is required.

CHAPTER VIII.

PERTUSSIS.

PERTUSSIS, or whooping-cough, is a contagious disease, and, in modern nosology, is classified with the zymotic affections. It is due to a specific cause, a *vis feris acuta*, the exact nature of which is not known. It may occur both in the epidemic and sporadic form. It is probably not inoculable, nor is it propagated by a third person, nor by fomites, although it is highly infectious, either through the breath of the patient, or by exhalations from his surface. With rare exceptions, it affects the same individual but once. Billist and Barthez report a case of its second occurrence, and a case is also reported by Dr. West. I have never attended a patient in two attacks, though I can recall to mind two individuals, both women of intelligence, who stated that they had previous attacks in early life. It occasionally affects young infants, even those less than one month old; and, on the other hand, adults, and rarely even old people; but most cases are between the ages of one and seven years.

SYMPTOMS.—Pertussis consists of three stages—first, the catarrhal; secondly, the stage of spasmodic cough—or, for brevity, the spasmodic stage; thirdly, the stage of decline.

The first period is characterized by the symptoms of coryza and bronchitis. The eyes present a moderately suffused and injected appearance. There is sneezing, with defluxion from the nostrils; and there is also more or less cough, dependent on bronchitic inflammation. The cough does not differ in character from that in the first stages of simple bronchitis, and there is little or no expectoration. Tronseau has known the cough to be repeated forty or fifty times per minute; but such great frequency is rare. The pulse and respiration are moderately accele-

rated, and such other symptoms as commonly accompany inflammatory affections of a mild grade are present, namely, increased heat of surface, thirst, and impaired appetite.

The duration of the first stage is various. It may, in rare instances, last only two or three days; *ie.*, on the other hand, be protracted even to six weeks. Its ordinary duration is from eight to fifteen days. In fifty-five cases observed by Dr. West, its average duration was twelve days and seven-tenths of a day. I have met two cases, both girls over the age of six years, in whom no spasmodic cough was noticed. If there was any, it was limited to a few paroxysms, and it might, therefore, be said that there was but one stage, namely, the catarrhal. They had the symptoms of the catarrhal stage, but instead of the occurrence of the spasmodic cough at the usual period, the inflammatory symptoms abated somewhat, and there remained an occasional easy cough, like that of simple subacute bronchitis. This continued during a period which corresponded with the duration of pertussis. The diagnosis in these cases would have been doubtful, except for the simultaneous occurrence of pertussis, with its regular stages, in other children of the same families.

SECOND PERIOD.—This supervenes gradually. At first, while the cough ordinarily has the character presented in the first stage, it is now and then observed to be more severe and spasmodic. The spasmodic element increases gradually, so that in the course of a week all doubt as to the nature of the disease, if any previously existed, is removed.

The severity of the cough in the second stage varies considerably in different cases. It sometimes occurs quite abruptly, but commonly there is premonition of it. The patient endeavors to repress it. If a child, he leaves his playthings, and rests his head on his mother's lap, or takes hold of some firm object for support; his face has a grave or even anxious appearance, while the pulse and respiration are somewhat accelerated. Immediately the cough commences. It consists in a succession of short and hurried expirations, which expel a large part of the air contained in the lungs, followed by a rapid and deep inspiration. There may be a single series of expirations, terminating in the manner mentioned; but often there are two, three, or more such series embraced in a paroxysm. The paroxysm commonly ends in the expulsion of more or less frothy mucus from the bronchial tubes,

and sometimes in vomiting. The rapid passage of air through the glottis, in the inspiration which terminates the cough, is sometimes accompanied by a sound, which is called the hoop. During the cough there is temporary arrest of blood in the lungs, leading to congestion in the right cavities of the heart and throughout the systemic circulation; therefore the face is flushed and swollen, and occasionally hemorrhage occurs under the conjunctiva, or from one of the mucous surfaces. The most frequent hemorrhage is epistaxis. When the cough ceases, and normal respiration is restored, the fulness of the vessels immediately abates; but often pallor of the features is observed, due to serous infiltration of the subcutaneous cellular tissue, and continuing for days or weeks during the period when the cough is most severe.

The paroxysm lasts from a quarter to a half or even a whole minute, and in that time, in severe cases, there are often as many as fifteen to twenty series of expirations. The hoop is not as loud in infants as in children, and in young infants, especially those under the age of six months, it is often lacking, although the cough may be severe.

At the close of the paroxysm, if there is no complication, the symptoms soon abate; the temperature, pulse, and respiration become normal, and there is no evidence of disease. The cough in the second stage is much more frequent in one case than another. At the height of this stage it is generally more severe, if it occur at long intervals than when frequent. During the weeks in which pertussis is most severe there is, in the average, about one paroxysm of coughing to each hour.

The cough increases in severity till the third week of the second stage, or the thirtieth to thirty-fifth day of the disease, after which it remains stationary for a certain time. It is apt to be more frequent in the night than daytime. Sometimes it occurs while the child is quiet; it may even awaken him from sleep, but it is often, also, produced by mental excitement, or by physical exertion. Anger or fright gives rise to it, and therefore the child is apt to cough, when being examined by the physician, or when his wishes are not complied with. The ordinary duration of the second stage is from thirty to sixty days. It may, however, be considerably longer or shorter than this.

The third stage, which commences at the time when the

spasmodic cough begins to abate, is short, not continuing longer than two or three weeks. A protracted stage of decline indicates some complication. While the sputum in the second stage is mucous and frothy, that in the third stage is more opaque and puriform.

In the third as in the second stage, if there is no complication, the pulse and respiration in the intervals of the paroxysms are nearly or quite natural. Febrile excitement may, however, now and then occur from trilling causes, or, indeed, without any apparent cause. The digestion and the general health in uncomplicated pertussis remain unimpaired, with the exception of more or less emaciation, which is apt to occur in all but the mildest cases, in consequence of the frequent vomiting. After complete recovery it is not unusual for the spasmodic cough to reappear, at times, for one or even two years. The cough of ordinary simple laryngitis, or bronchitis, assumes this character.

COMPLICATIONS.—These, like the symptoms, are chiefly of a twofold character, namely, inflammatory and neurogætic. From the nature of the cough in this disease, it would naturally be supposed that that spasmodic affection, which is now designated internal convulsions, and which is characterized by spasm of certain muscles of respiration, would be a frequent complication. It does sometimes occur in young children, but it is not common. Clonic convulsions affecting the external muscles are, on the other hand, not infrequent. They occur chiefly in the second stage, when the cough is most severe, and in infancy much more frequently than in childhood. They are apt to be general and severe, or, if not of this character at first, to become such. The convulsions commence, in most instances, in or directly after the paroxysm of coughing; but they may occur in the interval.

Rilliet and Barthès remark; "Almost all infants succumb to this complication, ordinarily in the twenty-four hours which follow the first attack; nevertheless life may be prolonged during two or three days" (Article, *Croup*). In my own practice this complication of whooping-cough has usually terminated fatally, but I have known recovery to occur somewhat unexpectedly under the use of bromide of potassium. In the month of June, 1867, I was attending a little girl two years and four months old, who had reached the fifth week of pertussis, when she was seized with general clonic convulsions. The mother,

who was requested to keep a record of the number of convulsions, stated that there were twenty in all, occurring within forty-eight hours. They affected both sides, the shortest lasting only three or four minutes, the longest seventy-five minutes. The treatment in this case, which eventuated favorably, will be noticed hereafter.

In those who die of convulsions occurring in hooping-cough, the most constant lesion is congestion of the cerebral veins and sinuses, with perhaps serous effusion. This congestion is due in part to the cough, which precedes the convulsions, and in part, to the convulsions themselves. At the autopsy which I have made of two infants, who died in hospital practice from hooping-cough, accompanied by convulsions, all the cerebral sinuses were filled with clots, which were generally soft and dark; but in the lateral sinuses clots were found, which were light-colored. The light color of a clot, either in a vein or sinus, indicates its ante mortem formation.

The gravity of the convulsive attack can be ascertained by observing whether the patient readily recovers consciousness, which is proof of any serious congestion of the brain. On the other hand, great drowsiness remaining, or a semi-comatose state, indicates persistent congestion, and perhaps even the formation of clots in the sinuses of the brain. Death from convulsions is usually preceded by coma. Occasionally meningeal apoplexy occurs, and death is immediate.

The most frequent inflammatory complications are bronchitis and pneumonitis. Inflammation of the larger bronchial tubes has been seen to be an almost uniform accompaniment of the stage of invasion, but it seldom, in this stage, becomes so severe as to constitute a complication. Both bronchitis and pneumonitis, when occurring as complications, are developed, with few exceptions, in the second stage. Bronchitis is accompanied by accelerated respiration and pulse, and increased temperature. The danger is proportionate to the amount of dyspnea. In the infant the smaller bronchial tubes are apt to be affected, constituting capillary bronchitis; this is attended with great embarrassment of respiration, and its result is usually fatal. If the bronchitis do not invade the smaller tubes, and if the general health is good, a majority of those affected with this complication recover by proper treatment. Bronchitis complicating hooping-cough is,

however, more protracted than when occurring as a primary disease.

Pneumonia is a less common complication than bronchitis, but it occurs more frequently in pertussis than in any other constitutional affection of early life, excepting measles. It is thought by some that the congestion, which occurs in the lung during the cough, favors the development of pneumonia. The symptoms and physical signs which accompany this inflammation and serve for its diagnosis are the same as in the primary form of the disease, and are described elsewhere. Bronchitis or pneumonia usually moderates the severity of the spasmodic cough. While the inflammatory element in pertussis increases, the spasmodic abates. On the abatement of the inflammation, however, the cough usually regains its former convulsive character. The fact may be stated in this connection, that any complication or intercurrent disease, which is attended by decided febrile reaction, ordinarily renders the cough for the time less spasmodic.

The occurrence of bronchitis or pneumonia is shown by the elevated temperature, acceleration of pulse and respiration, short and frequent cough. These symptoms do not cease as long as the inflammation continues, whereas in uncomplicated pertussis the patient seems nearly or quite well between the coughs. In pneumonia the respiration is accompanied by the expiratory moan, and in both bronchitis and pneumonia there is more or less depression of the infra-mammary region during inspiration. These symptoms, in connection with the physical signs, render diagnosis in most instances easy. Although the general character of the cough is changed, a cough now and then occurs, even when the inflammation is pretty severe, sufficiently spasmodic to indicate the nature of the primary affection. Bronchitis limited to the larger bronchial tubes does not materially increase the danger, except in feeble children. Capillary bronchitis and pneumonia are always serious complications.

It is stated by some writers that the spasmodic cough of pertussis occasionally gives rise to emphysema, and dilatation of the bronchial tubes. Others, as Rilliet and Barthez, do not believe that these structural changes occur from such a cause, because the spasmodic character of the cough of pertussis pertains to expiration. I have elsewhere stated that emphysema is very common in young infants. I have often observed it at the onset

sies of those who have never had any severe disease of the respiratory organs, and it has appeared to me that ordinary bronchitis may give rise to it. It is highly probable that pertussis, especially when complicated by severe bronchitis, may give rise both to emphysema and dilatation of the bronchial tube.

At the meeting of the New York Pathological Society, October 14th, 1868, I exhibited emphysematous lungs removed from an infant who died at the age of nineteen months and at the commencement of the fourth week of pertussis. Death occurred from thrombosis in the lateral sinuses of the cranium, resulting from the severe spasmodic cough, clonic convulsions, and from feebleness of the circulation, as the infant was previously in a reduced state from the summer complaint. At the autopsy the superior lobes of both lungs were found exsanguine, doughy to the feel, and enlarged so as to rise above the level of the other lobes. The resiliency of the elastic tissue of these lobes was evidently greatly impaired, and their air cells in a state of over-distension. The other lobes were healthy, except that one of them was the seat of lobular pneumonia. In the history of this case it did not appear that there had been any pathological state affecting the respiratory system previously to the pertussis, so that the commencing emphysema was apparently referable to this disease. The forcible and deep inspiration which terminates the cough of pertussis may aid in the production of emphysema in the infant.

I have occasionally met cases in which partial collapse of the lungs appeared to have occurred, and the mechanism of the cough is such that this would be a more probable result than enlargement of either the tubes or air cells. Collapse, like emphysema, may continue for weeks or months subsequently to pertussis, and then gradually disappear.

DIAGNOSIS.—During the period of invasion it is impossible to diagnose pertussis. Its nature can only be conjectured from a known exposure, or from the epidemic occurrence of the disease. In the second stage, which is characterized by the spasmodic cough, diagnosis is ordinarily easy, and often the parents are able to announce the nature of the disease when the physician is called. Still, a mistake is sometimes made; a spasmodic cough very similar to that of pertussis occasionally occurs in

other diseases. Young infants with bronchitis frequently experience great difficulty in the expectoration of mucus, which collects in the air passages, and provokes a suffocative cough. The following facts will aid in making the diagnosis. Bronchitis, accompanied by a suffocative cough, is an acute disease, and the cough occurs at an early period, usually in the first week. It lacks the inspiratory sound or the hoop, and is associated with constantly accelerated respiration and well-marked febrile symptoms, dependent on the inflammation. Moreover, the cough is only occasionally suffocative, according to the amount of mucus in the tubes. The spasmodic cough of pertussis, on the other hand, is preceded by the stage of invasion. This cough occurs in the second stage, when the febrile symptoms have abated; if the disease is uncomplicated, it is accompanied by a hoop, and its ordinary character is spasmodic. Again, the suffocative cough of bronchitis rarely ends in vomiting, which has been seen to be so common in the cough of pertussis.

The only other disease, with which there is much likelihood of confounding pertussis, is bronchial phthisis. The points of differential diagnosis are the following: the one epidemic, and spreading by contagion; the other non-contagious, and isolated; the one embraced in three distinct stages, and much shorter; the other chronic, and presenting no stages, but commencing with mild non-febrile symptoms, and progressively becoming more severe; in the one an absence of symptoms in the intervals of the cough, provided there is no complication; in the other constant symptoms, such as are common in tubercular disease. The previous health, and the presence or absence of a tubercular cachexia should be considered, in determining the nature of the disease, and usually, in bronchial phthisis, the lungs are also affected, so that auscultation and percussion may furnish positive proof of the nature of the cough.

Prognosis.—This is ordinarily favorable. Nearly all recover, unless some complication arises. In rare instances death may occur in, or immediately after a paroxysm of coughing, in consequence of the rupture of the cerebral capillaries, and the occurrence of apoplexy. Most fatal cases, however, are complicated with either clonic convulsions, bronchitis, pneumonia, or, in the summer season, enterocolitis, and death is due to the complication rather than the pertussis. It has been stated elsewhere that clonic

convulsions render the prognosis unfavorable, but the case detailed above shows that some may recover. If the convulsion is succeeded by marked drowsiness, the prognosis is very unfavorable. It is probable that other convulsions will occur, ending in coma. Immediate recovery of consciousness shows a less dangerous form of convulsions, and one which, with proper treatment, may terminate favorably.

The danger in bronchitis and pneumonia depends on the extent of the inflammation, the amount of dyspnea, the age and strength of the patient. Capillary bronchitis and pneumonia, are always serious complications. They have been the cause of death in a large proportion of the fatal cases, which I have attended. Pertussis sometimes is attended with so much emaciation and loss of strength, in consequence of the vomiting, that intercurrent diseases, which, in favorable states of the system, would probably end favorably, are very apt to prove fatal. In this city epidemics of the diarrhoeal affections, so common among infants in the summer, are much more fatal, if at the same time there is an epidemic of pertussis. In my practice, an infant affected at the same time with the "summer complaint" and hooping-cough has generally perished, unless removed to the country. If there is much emaciation and an hereditary tendency to tuberculosis, the prognosis is more unfavorable, on account of the probable concurrence of this disease.

TREATMENT.—In the catarrhal stage the treatment should be the same as in idiopathic catarrh. It should consist of mild counter-irritation to the chest. If there is much bronchitis, with accelerated breathing, the oil-silk jacket may be applied. Demulcent, laxative, and gentle expectorant mixtures are proper. Care should be taken to employ nothing, which would reduce the strength, or in any way impair the general health.

Therapeutic measures are most beneficial in the second stage, or that of convulsive cough. Proper treatment may prevent or control complications, which arise chiefly in this stage, and may moderate the intensity of the cough. Many formulae have been recommended for the treatment of pertussis, most of them containing some antispasmodic. Oxide of zinc, musk, asafoetida, valerian, cochineal, the anaesthetics, and many other medicinal agents have been employed, and there are physicians with whom each of these has had its season of repute. The three medicines

which are most in favor with the profession at the present time, and in my opinion properly so, are hydrocyanic acid, belladonna, and bromide of ammonium. The employment of the last of these is comparatively recent. The others are old remedies, and their therapeutic effects are more fully ascertained. In my opinion the treatment by belladonna is usually most successful, and this agent is more employed than any other. Some of the belladonna of the shops, as is true likewise of hydrocyanic acid, is of inferior quality, either from its mode of preparation, or the manner in which it has been kept, and is therefore not reliable. But if good, and prescribed properly, it will ordinarily produce some amelioration in the cough. The extract is commonly prescribed in this country, as it is equally convenient for use with the tincture, and more reliable.

The first dose of belladonna should be smaller than will probably be required to ameliorate the disease. The child, however, requires a larger proportionate dose of belladonna than an adult to produce the same effect. Tronseau's great experience in the treatment of children's diseases, and his successful practice, render his views in reference to the employment of this agent deserving of careful consideration. For young children he directed pills to be made, each containing about one-tenth of a grain of extract of belladonna mixed with an equal quantity of the powder of the leaves of belladonna.

For children over the age of four years, the pills contained one-fifth of a grain of the extract and the same quantity of the powder. He directed that one of these pills should be taken in the morning when the stomach was empty, and a second on the following morning. The nurse marked on a card each paroxysm of coughing, so that the effect of the medicine could be ascertained. If the number of paroxysms were diminished, or the cough rendered less severe, so that there was evidently decided amelioration, the same dose was administered each day. If, on the other hand, there were no improvement in the number, or severity of the paroxysms, two pills were given on the following morning, three on the next, and so on till an appreciable effect was produced. Tronseau considered it important to give at one dose whatever belladonna is administered during the day. The same quantity per day given in small doses, at intervals, he believed to be less effectual.

The dose which he found to produce amelioration of the symptoms he ordered to be repeated daily during the succeeding six or eight days. Then if the improvement continued, the dose was gradually diminished by one pill each day back to the first dose, but if the cough increased the dose was again increased.

Finally, when the spasmodic cough had entirely ceased, Troussseau advised the continuance of the medicine six or eight days longer before its complete suspension.

Troussseau sometimes employed atropine in place of belladonna, since the medicinal properties of the plant reside in this alkaloid, and, being crystalline, its strength is always uniform. He gave the neutral sulphate of atropine in dose of about $\frac{1}{14}$ part of a grain, dissolved in distilled water, to infants or young children in the same manner as he prescribed belladonna. For older children he ordered a dose proportionately larger. Brown-Séquard, in remarks made before the United States Medical Association in May, 1866, maintained that the duration of pertussis, so far as the neuropathic element is concerned, might be abridged to a few days, by doses of atropine sufficiently large to produce toxic effects. He recommends a dose which will cause, and repeated will maintain, delirium for three days; after which, he states, the cough is no longer spasmodic.

The older physicians, who first advised the employment of belladonna in pertussis, as Schaeffer, Guernant, Göllis, and Wendt, used it with caution, and in small or moderate doses, apparently believing that its use involved considerable danger. It is now, however, considered a safe as well as efficient remedy, and it is admitted that in pertussis the full benefit of the drug can only be obtained from doses which produce a decided impression on the system. If there is no amelioration of symptoms from smaller doses, it is proper to give it in a quantity, which will cause dryness of the fauces and efflorescence upon the skin.

The preparation of belladonna which I commonly employ is the extract, in one grain pills. If the patient is an infant one year old, one pill may be dissolved in eight teaspoonfuls of water; if three years old, in four, and a teaspoonful given once, or if there is no appreciable effect, twice, or three times daily. If there is no modification of symptoms, an additional half spoonful should be given on the third day, and afterwards a still farther increase will probably be required. This mode of giving belladonna is

more convenient than the administration in the pill, as recommended by Trouessart; and there is equal exactness in the dose. Exactness in the dose is a matter of importance in the use of this agent, and it is not attained in the ordinary way of giving liquid medicines, on account of the great difference in the size of spoon. The dose which proves sufficient to control the disease should be administered daily for a time, and then gradually diminished as the cough declines. Hydrocyanic acid possesses the power of controlling the spasmodic cough of pertussis. It is recommended by Dr. West. "I usually begin," says he, "with a dose of half a minim of the acid of the London Pharmacopœia (that of the U. S. Ph. is the same) every four hours for a child nine months old; and so in proportion for older children. The specific influence of the remedy is, I think, both more safely and efficiently exerted by increasing the frequency of its administration than by adding to the dose, and I should therefore prefer to give half a dose every two hours, rather than to double the dose without increasing the frequency of its repetition. This remedy sometimes exerts an almost magical influence on the cough, diminishing the frequency and severity of its paroxysms almost immediately; while, in other cases, it seems perfectly inert." Dr. West has employed this remedy several hundred times, and only once has observed alarming symptoms from its use. The patient was two and a half years old, and had been ordered one minim of the dilute acid every four hours. He took the acid for four days without any effect being produced, either on his system generally, or on the cough; but at the end of that time, after taking each dose, he uttered a cry, became quite faint, and would have fallen, if not supported.

Hydrocyanic acid, given in safe doses, does not appear to produce amelioration of symptoms in so large a proportion of cases as belladonna, and I do not know any advantages which it possesses over that agent. Belladonna never produces sudden alarming symptoms, like the acid. If, through mistake, more than the prescribed quantity is administered, it may cause delirium, and the characteristic effect on the mucous membrane of the throat and upon the skin; but a gradual disappearance of these symptoms may be confidently expected, without any injury to the patient. If for any reason it is thought best to prescribe

hydrocyanic acid, the following formula from West may be employed:—

R.—Acid. hydrocy. dil. ℥iv;
Syrupi simplici ℥j;
Aqua destillat. ʒvj.—M.

A teaspoonful is to be taken every six hours for a child nine months old.

R.—Acid. hydrocy. dil. ℥iv;
Mistur. amygdale ʒj.—M.

Doce the same.

The bromides have, within a few years, been used in the treatment of pertussis. They were first recommended by Dr. Gibbs, and subsequently by Prof. Harley, of London. It is claimed for them, that they produce an anæsthetic effect on the mucous membrane of the larynx. The bromide employed by the above and other physicians has commonly been that of ammonium, but some have employed that of potassium, or the two in combination. Prof. Harley gives one grain of the bromide of ammonium for each year of the patient's age, three times daily; Dr. Gibbs gives two or three grains every eight hours to infants, and from four to ten grains to older children. Dr. Ritchie, Physician to the Royal Edinburgh Hospital for Sick Children, says of it (*Edinb. Med. Jouro.*, June, 1864): "In my experience, the remedy appears to be most successful in children whose age exceeds two years. . . . The quantity I have generally given has been from three to twelve grains a day, in divided doses, administered every six hours. . . . Having used the preparation in upwards of twenty cases, if I may be allowed to express an opinion on this head, it would be that the great efficacy of the drug is in uncomplicated cases; that in those complicated with acute bronchitis, or pneumonia, the benefit is so trifling that I prefer other methods of treatment; for an acute congested condition of the air-passages appears to lessen the effect of the bromide as a laryngeal anæsthetic; that the more frequent the paroxysms of whooping, the more marked and rapid is the relief; that greater relief appears to be experienced in those of some continuance than in recent cases; and, lastly, that when chronic bronchitis is present, the bromide should not be given alone, but combined with squill and spearmint mixture, and occasionally with an emetic."

I have employed the bromides, though not largely, in the treatment of pertussis, but have not, in ordinary cases, observed

that benefit which I had been led to expect. In recent cases, I believe that belladonna is a more efficient remedy. I would use the bromides chiefly in advanced cases, and in cases, whatever the period of pertussis, in which there seems to be imminent danger of clonic convulsions. In these last cases, the bromide of potassium, with or without that of ammonium, may, in certain cases, prevent the convulsive seizure.

There are many other remedies which have been vaunted in the treatment of pertussis, and which do moderate the severity of the cough. Some, it seems to me, have this effect by producing febrile excitement. Such is the use of cantharides, so as to produce active congestion of the urinary passages and strangury; severe counter-irritation over the chest by tartar emetic, namely, Autenrieth's treatment, etc. Emetics have sometimes been prescribed in the first stage of pertussis, in the belief that they moderated the severity of the disease. They are more frequently employed on the Continent than in this country. Larnoe says: "Not any measure is more useful in the commencement of pertussis than vomiting, repeated every day or every two days, during one or two weeks." Some physicians have given for this purpose ipecacuanha, and others sulphate of zinc. Trouessart employed sulphate of copper. The loss of strength, however, which necessarily attends the employment of emetics, renders it doubtful whether they should be given in this disease, except occasionally, when there is considerable accumulation of mucus in the tubes, which an emetic assists in expelling.

A remedy long in use, and still a favorite with many families, consists of half a scruple of cochineal, one scruple of carbonate of potassa, one drachm of sugar, and four ounces of water. The dose for a child one year old is a dessert-spoonful three times daily; for older children the dose is increased in a corresponding degree. It is believed by some that the cochineal is inert, and that the beneficial effect of the above mixture is due to the potassa, which modifies the accompanying bronchitis.

Alum, in doses of one to six grains, according to the age, is recommended by Dr. J. F. Meigs (*Treatise on Diseases of Children*). Inhalation of the fumes arising from the purification of gas, has been recommended in Paris as an effectual remedy in the declining stage of pertussis. On the other hand, it is claimed that simple change of air is equally beneficial at this stage of the dis-

case. M. Roger employed these fumes in the wards of the Children's Hospital, Paris; but apparently without benefit. Nitric acid has also been used internally, and applications of nitrate of silver to the throat; both, it is stated, with improvement in certain cases. Change of air is always beneficial in whooping-cough. In uncomplicated cases the child should be carried daily into the open air. Great benefit, as regards the severity of the cough, often accrues, especially in the advanced period of the disease, by removing the child to the country, or to another locality.

Severe bronchitis, or pneumonia, which often complicates pertussis, requires the treatment which is elsewhere recommended for the secondary form of this inflammation. Clonic convulsions, which we have seen are a common and very serious complication, should be treated by cold to the head, a warm foot-bath, and laxatives in certain cases. The medicine which, in my opinion, is most likely to control the spasmodic movements, is bromide of potassium. The mode of administering this agent has already been sufficiently stated in our remarks on the treatment of eclampsia. In the case alluded to in the preceding pages, in which there were twenty convulsions within forty-eight hours, and the patient, two years and four months old, recovered, the bromide of potassium was given in combination with the iodide. The dose was about two grains of each every two or three hours.

CHAPTER IX.

PAROTIDITIS.

IN most cases parotiditis, or mumps, has no premonitory stage: in exceptional cases, slight languor with fever precedes the disease for a few hours. Mumps commences with tenderness in the parotid region, followed soon after by tumefaction. The swelling gradually increases; it fills the depression under the ear, extends forward and upward upon the cheek, and downward to a greater or less extent upon the neck. It is due to active congestion of the parotid gland, accompanied sometimes by more or less oedema

of the surrounding cellular tissue. It reaches its maximum from the third to the sixth day. The most prominent point at this time corresponds with the lobule of the ear. The tumor is firm, but slightly elastic. It presses outward the lobule of the ear. In most cases the skin preserves its normal appearance over the swelling, but occasionally it presents an indistinct blush. The pressure which movements of the jaw produce on the swelling, renders mastication and even talking painful. Febrile movement more or less intense occurs, lasting, in ordinary cases, not more than forty-eight hours, but occasionally it is more protracted. Vomiting and epistaxis are sometimes present. When the swelling has attained its maximum size it remains stationary a short time, when it begins to decline, and by the sixth to tenth day it has entirely subsided.

In most cases parotiditis is double; it commences on one side, and in from one to three or four days the other parotid becomes affected; the disease oftener commences in the left than in the right parotid. In those exceptional cases in which only one parotid is affected, the opposite gland may be the seat of the disease at some subsequent period. It has been estimated that the proportion of unilateral to double mumps is as one to ten.

The total duration of this disease is usually from eight to ten days; in the mildest cases it may not be more than five days. The submaxillary glands are often involved in connection with the parotids, and sometimes also the sublingual, although from their small size and concealed position their tumefaction escapes notice. Rarely the tonsils are also tumefied. Sometimes free perspiration occurs at the commencement of convalescence.

In comparatively rare instances the swelling of the parotids abates suddenly, and in the male the testicle, epididymis, and tunica vaginalis, become inflamed; while in the female the mammary glands and the labia majora are the seat of the metastasis. This metastasis is much more rare before the age of puberty than subsequently; it is accompanied by considerable constitutional disturbance. This new manifestation of the disease usually disappears within a week.

NATURE.—Parotiditis is contagious; it is rare in infancy and after middle life; it occurs mainly in childhood, youth, and early manhood; its period of incubation appeared to me, from observations made in the Protestant Episcopal Orphan Asylum of this

city, to be about twelve days. It is a blood disease having the singular local manifestation which has been described above, and which is our only means of diagnosis. The tumefaction of the salivary glands is due to an active determination of blood to them. We do not have an opportunity of post-mortem inspection of these glands, but there is reason to think that this determination of blood is not, properly speaking, inflammatory, since the sudden disappearance of the swelling shows that there can be no inflammatory exudation into the substance of the glands. The anatomical change, which the glands undergo, is congestion of its vessels with serous effusion or oedema.

DIAGNOSIS.—If the physician has seen but few cases of mumps, there is danger that he may mistake the swelling for an inflamed cervical gland, or vice versa, but an inflamed cervical gland presents to the finger a hardness almost like that of cartilage, and it is circumscribed or round, and does not invest the ear. These characteristics contrast with the elasticity, seat, and shape of the parotid swelling which extends forward on the cheek, and surrounds and elevates the lobule of the ear. Tumefaction resulting from diphtheritic or any other form of facial inflammation, or from periostitis affecting the root of the posterior molar, may be detected by examining the fauces and interior of the mouth.

TREATMENT.—This is very simple. Oakum or carded wool may be bound over the swelling, and the surface occasionally rubbed with sweet oil. Mild laxative, and diaphoretic drinks, such as bicarbonate of potash or lemonade, are useful. If metastasis occur, the new local affection should receive chief attention. It should be treated in the same manner as if it occurred independently of the mumps.

CHAPTER X.

SYPHILIS.

SYPHILIS in infancy and childhood presents itself under two forms, namely, the congenital and acquired; the former is the more frequent.

ETIOLOGY.—Congenital syphilis may be derived from either

father or mother. Either parent, having previously had syphilis, may transmit it to the offspring, although at the time free from syphilitic symptoms. The mother, healthy at the time of conception, but infected with syphilis prior to the eighth month of gestation, may communicate the disease to the fetus; syphilis contracted in the eighth or ninth month does not affect the fetus. If both parents have syphilis, the infant is almost necessarily syphilitic; on the other hand, if only one parent is affected, the infant may or may not be contaminated. Sometimes, with such parentage, a part of the children are syphilitic, and a part healthy.

Acquired syphilis in infancy and childhood may be received through primary lesions; that is, by reception of the virus from a chancre or bubo; or it may be derived from certain of the secondary lesions. Inoculation by primary lesions may occur at the birth of the infant from a syphilitic sore in the vagina, or upon the vulva of the mother; inoculation in this manner is, however, rare. Children may also receive the virus from primary lesions on the persons of nurses or companions. Infection in this manner is sometimes accidental, and sometimes the result of criminal conduct. A chancre on the breast of the wet-nurse not very infrequently communicates syphilis to the nursing.

The contagiousness of "secondary manifestations," for a long time doubted, is now fully established. Syphilis may be communicated by the secretion or exudation of a mucous patch, or a secondary sore. Hence the danger of infection by unhealthy wet-nurses, though they present no symptoms of recent syphilis. Excoriations or sores upon the nipple or breast of an infected wet-nurse, may communicate the disease to the nursing; and, on the other hand, mucous tubercles or fissures upon the lips or tongue of the infected infant may be the means of contaminating a healthy wet-nurse. Many such cases are now contained in the records of medicine. Vaccination by means of the wash is also a mode by which constitutional syphilis may be communicated. For further particulars in reference to this subject the reader is referred to our remarks on vaccination.

CLINICAL HISTORY.—Syphilis occurring in the fetus often destroys its life and produces miscarriage. So frequently is syphilis a cause of non-viability, that, as Trousseau has remarked, this disease should be suspected as the cause, whenever a woman

repeatedly aborts. Abortion from syphilis commonly occurs at or about the sixth month of gestation.

The viable infant, affected with syphilis, commonly presents, at birth, no symptoms or appearances which indicate the nature of the disease with which it is contaminated. But there are exceptions. Bouchut saw a seven and a half months infant with an eruption of a copper-color upon the legs and arms, and onyxia upon the fingers and toes. Pempfigna, condylomata, mucous patches, and stains of a copper color are the principal syphilitic lesions which have been observed at birth on the bodies of contaminated infants. The infrequency of syphilitic manifestations at birth is evident from the experience of M. Cullerier, who in ten years' attendance at the Hôpital de Lorraine met only two cases. Victor de Meric met only two cases in forty-six infants, who were affected with congenital syphilis (*Burstead*).

It is rare that congenital syphilis manifests itself before the fifteenth day after birth; the period in which it is first revealed by symptoms is commonly between the fifteenth and fortieth days. Very rarely the manifestation of the disease is delayed several months. M. Diday ascertained the time of the commencement of symptoms in 155 cases, as follows:—

Before the completion of one month after birth, in	86
" " two months "	45
" " three "	15
At four months	7
" five "	1
" six "	1
" eight "	1
" one year	1
" two years	1

In cases of tardy commencement of syphilitic symptoms, it has been suggested that the disease has been partially eradicated by anti-syphilitic treatment of the mother during her gestation, or during lactation.

The nutrition of the infant, who has inherited the syphilitic taint, is for a time good, but it begins to be impaired when the local manifestations of syphilis appear, or soon after. The system gradually wastes, the skin loses its fresh and healthy appearance and becomes sallow, and, after a time, more or less wrinkled; the features become pinched or contracted, and wear a sad expression. M. Diday says: "Next to this look of little old men,

so common in new-born children doomed to syphilis, the most characteristic sign is the color of the skin." Trousseau, who has studied it carefully, thus describes it: "Before the health becomes affected the child has already a peculiar appearance; the skin, especially that of the face, loses its transparency; it becomes dull, even when there is neither puffiness nor emaciation; its rosy color disappears, and is replaced by a sooty tint, which resembles that of Asiatics. It is yellow, or like coffee mixed with milk, or looks as if it had been exposed to smoke; it has an empyreumatic color, similar to that which exists on the fingers of persons who are in the habit of smoking cigarettes. It appears as if a layer of coloring had been laid on unequally; it sometimes occupies the whole of the skin, but is more marked in certain favorite spots, as the forehead, eyebrows, chin, nose, eyelids, in short, the most prominent parts of the face; the deeper parts, such as the internal angle of the orbit, the hollow of the cheek, and that which separates the lower lip from the chin, almost always remain free from it. Although the face is commonly the part most affected, the rest of the body always participates more or less in this tint. The child becomes pale and wan."

The infant, whose system is profoundly affected by syphilis, rarely smiles, and its voice is feeble and plaintive; its frequent whimpering cry is quite characteristic.

Coryza is one of the most constant of the local affections which occur in infantile syphilis. It gives rise to a secretion from the Schneiderian membrane, at first thin, but which becomes more consistent, and is attended by the formation of scabs. The thickening of the mucous membrane in consequence of the inflammation and the presence of crusts, narrows the passage through the nostrils so as to produce snuffing respiration, and sometimes interfere more or less with nursing. In severe cases respiration through the nostrils is almost wholly prevented, so that death may occur from inanition, in consequence of the difficulty in taking nutriment. The inflammation at the same time may affect the throat and larynx, causing hoarseness of the voice. Ulceration of the Schneiderian membrane, and the adjacent cartilage or bone is rare in infancy or childhood, although cases occur which are even attended with more or less flattening of the nose. The coryza, in most cases, coexists with other local syphilitic affections. Occasionally it occurs alone, and is the

only evidence of the presence of the specific taint, except such as is afforded by the mal-nutrition and general appearance of the patient.

MUCOUS PATCHES occur in most cases. They are developed either upon the mucous surfaces, or upon parts of the skin which are thin, exposed to friction, and are moistened by secretion or transudation, from the vessels underneath. The most common seat of mucous patches is at the termination of mucous canals; but in infancy, on account of the peculiar delicacy of the skin, they may occur upon almost any part of the cutaneous surface. They are most common, however, around the anus, upon the vulva, scrotum, umbilicus, labial commissures, in the axillæ, and behind the ears.

Mucous patches upon the skin present a rounded border, and are slightly elevated. Their color has been compared to that of the skin which has been softened by the prolonged application of a poultice. Erosions and cracks sometimes occur in the patches, from which a thin liquid exudes.

These patches upon mucous surfaces are less elevated than upon the skin, and are prone to ulcerate. The ulcerations, commencing at the centre, extend, and soon the mucous patch disappears, and its site is occupied by an ulcer. The ulcer may be circular, oval, elliptical, crescentic, or irregular.

ROSEOLA is an occasional symptom of infantile syphilis. "It is distinguished," says Didar, "by patches of a bright rose color, circumscribed, irregularly rounded, of various sizes (most frequently about as large as one of the nails); appearing, by preference, on the belly, lower part of the chest, neck, and inner surface of the extremities." It does not disappear readily by pressure.

PEMPHIGUS is sometimes present at birth, and when not, it is one of the first eruptions to appear. Its most frequent seats are the palms of the hands and soles of the feet. This eruption commences by a violet tint of the skin, and, in the course of twenty-four to forty-eight hours, a watery fluid collects underneath. Pemphigus at birth is usually a precursor of death. In cases of recovery it disappears in two or three weeks.

ACNE, IMPETIGO, AND ECHYMA, are occasionally observed in children affected with syphilis. The indurated pustules of acne occur most frequently upon the shoulders, back, chest, and but-

tocks. The pus is sometimes absorbed, and in other cases discharged, leaving a small cicatrix, which, after a time, disappears. Impetigo appears most frequently upon the face, and occasionally upon the chest, neck, axilla, and groins. Unlike simple impetigo, the syphilitic impetiginous eruption is surrounded by a copper-colored areola. Ecthyma occurs upon the legs and buttocks, chiefly. It commences as violet-colored spots, which are soon transformed into pustules. Ulcers succeed, which, in reduced states of the system, are apt to enlarge, and endanger the safety of the child. Of the three pustular eruptions, none, according to Diday, is the least serious—indicating a “less confirmed diathesis.” Ecthyma is the most serious, on account of the reduced state of system, with which it is apt to be associated. Syphilitic papule and squamæ are rare in infants, but cases have been observed. Onychia occasionally occurs, though less frequently than in syphilis of the adult.

VISCERAL LESIONS.—The visceral lesions which occur in the syphilis of infancy and childhood, are suppuration in the thymus gland, gummy tumors in certain organs—most frequently the lungs and liver—infiltration by fibrous substance through the liver, or syphilitic cirrhosis; partial peritonitis, with depressions resembling cicatrices on the surface of the liver; peritonitis, periostitis, with thickening of the bone; exostosis.

Suppurative inflammation in the thymus gland is not common, or has not been frequently observed. When it is present, the gland sometimes presents its normal appearance externally, and the abscess is only discovered by incision. Gummy tumors are white and spheroidal; some are as small, or smaller than a pin's head, while others are as large as a pea, or even a hazel-nut. I have seen a considerable number of them not as large as a pin's head, in the liver of an infant. Gummy tumors, according to Lebert, consist “of loose fibrous tissue, made up of pale elastic fibres, inclosing in their large interspaces a homogeneous granular substance, the elements of which are less adherent to each other than in deposits of true tubercle.” Lebert also, with other microscopists, discovered round granular cells in these tumors. According to Robin, gummy tumors “are made up of rounded nuclei, belonging to fibro-plastic cells, or *cytoblasts*; of a finely granular, semi-transparent and amorphous substance; and, finally, of

isolated fibres of cellular tissue, a small number of elastic fibres, and a few capillary bloodvessels."

Infiltration of the liver by fibrous substance was first noticed by Gübler. It is not common in the infant. A specimen, showing this lesion, was presented to the London Pathological Society in 1866, by Dr. Samuel Wilks. Dr. Wilks remarked to the Society: "Having dissected the bodies of several infants, who have died of congenital syphilis, I have found fatty livers, and an inflammation of the capsule; but in only two have I discovered adventitious products of a fibrous character. The present example, however, corresponds in every particular with the disease described by Gübler. It must be distinguished (at least as far as the naked-eye appearance reaches) from the syphilitic disease of adults, of which many specimens have been before the Society. In these the organ is circumscribed on the surface, and contains distinct nodules of fibrous tissue; whilst in the disease of children, as in the present specimen, the whole organ is infiltrated by a new material, and it consequently becomes, as described by Gübler, hypertrophied, globular, and hard, resistant to pressure, and even when torn by the fingers, its surface receives no indentation from them; it is also elastic, and when cut cracks slightly under the scalpel. This was the form of disease in the present specimen. It came from a syphilitic child, a month old, in whom the liver could be felt enlarged during life, and when removed weighed a pound and a half. It was smooth on the surface, and so hard that it resembled rather a fibrous tumor than a liver."

Syphilitic perihepatitis and periostitis are much more rare in infancy and childhood than in adult life. Prof. Simpson, of Edinburgh, considers peritonitis one of the results of syphilis in the fetus, and the proximate cause of its death.

PROGNOSIS.—The prognosis depends in great measure on the general condition of the patient. If there is much emaciation, and the local symptoms indicate a deeply-seated syphilitic cachexia, a considerable proportion perish. On the other hand, if the general health is not greatly impaired, although the local affections are pretty severe, the prognosis, with correct treatment, is good. The younger the infant, when the symptoms of syphilis appear, the more unfavorable, as a rule, is the prognosis.

TREATMENT.—Parents who beget syphilitic children ought,

from a due regard for their offspring, to make use of anti-syphilitic remedies, although they present in their persons no evidences of syphilitic taint. A good prescription for the parents is one-sixteenth of a grain of corrosive sublimate in the compound tincture of bark, given twice or three times daily for several weeks. If the father has had syphilis, both parents should be subjected to this treatment, and it may be continued, at least on the part of the mother, during the first months of her gestation. So small a dose of the mercurial does not, in my opinion, materially increase the liability to miscarry. There is much more danger of miscarrying from allowing the syphilitic taint to remain uncontrolled. Some prefer the use of mercurial ointment in the treatment of pregnant women for syphilis, in the belief that it is less likely to produce abortion. It is used for this purpose in the proportion of one drachm to the ounce. It is equally effectual in the eradication of the syphilitic taint with the small dose of corrosive sublimate, recommended above for internal administration; but it is impossible to determine the quantity of mercury which enters the circulation when inunction is employed, and salivation is more likely to occur.

Syphilis in the infant requires mercurial treatment as in the adult. Mercury may be employed internally or by inunction. Some prefer inunction in the treatment of ordinary cases, in the manner recommended by Sir Benjamin Brodie. "I have spread," says he, "mercurial ointment, made in the proportion of a drachm to an ounce, over a flannel roller, and bound it round the child, once a day. The child kicks about, and, the cuticle being thin, the mercury is absorbed. It does not either gripe, or purge, nor does it make the gums sore, but it cures the disease. I have adopted this practice in a great many cases, with the most signal success." Tromsden, on the other hand, discountenances the use of inunction, as mercurial ointment applied to the skin produces irritation, and increases the suffering and restlessness of the child. He prefers the following solution, which is known as Van Swieten's, for internal treatment:—

R.—Hydrag. bioloid. ʒ part;
Aque ʒ60 parts;
Spts. rectif. 100 parts.
Mise.

The dose for an adult is a teaspoonful. For the infant a proportionate dose may be given.

As regards the choice between inunction and internal treatment, it may be said that the former is preferable in very reduced states of system, and in those who are affected with diarrhoea. The ointment should not be applied to much of the surface; two or three square inches are sufficient. To avoid inflaming the surface the position of it may be varied from time to time, and it need not be continuously applied. In cases, other than those excepted above, I prefer internal treatment. Van Swieten's liquid may be given, or one of the following formulæ may be employed:—

R.—Hydrag. cum creta gr. ʒj-ʒj;

Succa. alb. ℥j.

Misce.

Divid. in chart. No. xii. One powder 3 times daily.

R.—Hydrag. chlor. corros. gr. i-ij;

Syr. sacch. comp. ℥j;

Aque ℥viij.

Misce.

One teaspoonful 3 times daily.

Mercury, in whatever way employed, should not be discontinued entirely till several weeks after the syphilitic symptoms have disappeared; it is proper to continue it for a time, in diminished quantity, after the health seems fully restored.

When the mercurial is omitted tonics are often required. The preparations of cinchona are useful in certain cases, as are also those of iron. The liquor ferri iodidi is especially useful in this class of cases.

SECTION V.

DISEASES OF THE SKIN.

CHAPTER I.

ERYTHEMA—ROSEOLA.

ERYTHEMA is a common and mild exanthem. This name is applied to red, superficial patches of variable extent, which may appear upon any part of the surface. Three forms of this disease occur in early life, namely: Erythema fugax, intertrigo, and nodosum.

ERYTHEMA FUGAX occurs chiefly in febrile states of system and during infancy. It is, therefore, a frequent accompaniment of internal inflammations, and of the essential fevers. Its most frequent seat is upon the face, neck, and trunk. The color of the rash is a bright red; it disappears momentarily on pressure; it is evanescent, continuing from three or four to twelve or twenty-four hours; it leaves no trace, except sometimes a slight furfuraceous desquamation.

ERYTHEMA INTERTRIGO is due either to friction of opposing surfaces of skin, or to the irritation of certain discharges. Its most frequent seat is the folds of the skin of the neck, thighs, or groin, or about the anus. When occurring about the anus or genitals, it is due to the irritating effect of the urine, or of acid alvine evacuations retained upon the surface. The inflammation is sometimes slight; disappearing in two or three days with proper treatment; in other cases the epidermis becomes denuded, the surface is tender and moist, and even superficial ulcerations occur. In severe cases the ulcers extend more deeply, and give rise to considerable purulent discharge; they are commonly seated in the lowest part of the depression, formed by the folds of the

skin. Erythema intertrigo occurring between the thighs and around the anus is most frequently met in infants with protracted diarrhoeal affections, whose stools are commonly acid. Many of these infants have thrush at the same time. This form of erythema is often protracted, unless the cause is removed.

A less frequent form of erythema, but which is occasionally met in children, is the *nodosum*. It occurs usually on the extremities; oftener upon the anterior part of the legs than elsewhere, and in those whose general health is impaired. The eruption is preceded by more or less languor, depression, and febrile reaction; it commences in red spots, which enlarge and assume an oval shape, and are slightly raised above the surface; their diameter is half an inch to an inch and a half, and they are tender on pressure; their color, at first a bright red, becomes gradually purplish, and finally presents a bruised appearance; the swelling is hard during the active period of the eruption, but the induration gradually abates, and disappears by the eighth or tenth day. Slight discoloration and desquamation succeed, after which the normal appearance and function of the skin are restored.

DIAGNOSIS.—Erythema fugax may be distinguished from erysipelas by the fact that it does not extend gradually along the surface, and is attended by no tumefaction from the subcutaneous infiltration and no tenderness. Erythema fugax is a transient eruption, giving rise to little constitutional disturbance, although there is often febrile reaction from the primary disease, which it accompanies; erysipelas, on the other hand, is more loosing, and it gives rise to great constitutional disturbance. The margin of the erysipelatous rash is regular and defined; that of erythema fugax usually irregular. The diagnosis of erythema intertrigo is always easy. Erythema nodosum may be distinguished from phlegmonous inflammations, by the slight constitutional disturbance, and the fact that it never suppurates.

PROGNOSIS.—The prognosis of erythema is always good. The danger is from coexisting diseases or from cachexia, which was present when the erythema began.

TREATMENT.—Erythema fugax requires no special treatment. Erythema intertrigo, if slight and not accompanied by destruction of the epidermis, and by moisture, may be treated by dusting the surface with powdered starch, which if thickly applied prevents attrition of the surfaces. If the erythema is around the anus or

about the genitals, strict attention should be given to cleanliness. The diaper should be removed as soon as soiled.

If the inflammation is more severe and is accompanied by moisture, the following will be found an excellent remedy:—

R.—Pale, steel oxid.,
Lycopodii, ss ʒi.
Misee.

To be dusted occasionally over the inflamed surface. It soon desiccates the surface and restores the inflamed skin to its healthy state. This disease may also be satisfactorily treated in most cases by the following wash:—

R.—Opel. sulphat. gr. ʒ-iv;
Aqua rose ʒij.
Misee.

To be kept constantly applied by means of linen saturated with it, and pressed between the inflamed surfaces. When this disease is caused by frequent acid stools, remedies which cure the diarrhoeal affection also cure the erythema.

In erythema nodosum local treatment is not required, unless there is considerable heat and tenderness, when a wash of sugar of lead and opium may be of service. As this form of erythema occurs in reduced states of system, tonics, vegetable or chalybeate, or both, are required.

Roseola.

The term roseola is applied to small, red, irregular patches, occurring over a greater or less extent of surface, accompanied by a degree of febrile reaction, and often by redness without swelling of the facial surface. The rash is accompanied in certain cases by tingling or pricking; its color at first is a bright red, but the hue becomes duller by degrees and gradually fades. The rash is often transient, not lasting more than one or two days, while in other cases it continues more than a week. It may in some forms be even chronic. Roseola may occur in any season, but it is most common in the warm months. Several varieties are described by dermatologists. Roseola may precede the variculous eruption, and also occur during the progress of vaccinia.

The forms of the disease which are designated roseola infantilis, roseola aestiva, or autumnalis, are the most common in

early life. They are in reality identical, or nearly so, and may be described as one disease.

SYMPTOMS.—ROSEOLA (INFANTILIS, ESTIVA, AUTUMNALIS), is preceded often by more or less fever, lassitude, and in those old enough to describe their sensations, headache, and pain in back and limbs. There is great difference, however, as regards the severity of the prodromic symptoms in different cases; sometimes they are almost absent. Occasionally there is vomiting, diarrhoea, or other symptoms of derangement of the digestive apparatus, immediately prior to the appearance of the rash.

The eruption appears first upon the neck and face, and in the course of twenty-four to thirty-six hours upon the rest of the surface. It bears considerable resemblance to that of measles; sometimes it is limited to a portion of the surface; the patches are irregular in shape, and though of a red color at first they soon present a dusky hue as they begin to fade; by pressure the redness disappears. In the majority of cases the eruption has nearly faded by the fifth day. The redness of the facial surface, together with the itching or tingling, disappears with the subsidence of the rash.

ROSEOLA ANNULATA is a rare disease. It commences with constitutional symptoms, which are slight or pretty severe, and which cease when the eruption appears. This appears in the form of red circular spots, which enlarge and assume the shape of rings, the inclosed surface presenting its normal appearance. The rings, when fully developed, are half an inch in diameter. They decline in a few days, often leaving a bruised appearance.

DIAGNOSIS.—The common form of roseola may be mistaken for measles. The points on which a differential diagnosis is based are absence of catarrhal symptoms, comparative mildness of the febrile reaction, greater size, and more irregular form of the eruption. Moreover, measles is commonly epidemic, several children being affected at once. Roseola bears in some respects a close resemblance to erythema, but the patches in erythema are larger, and they have a bright red color; in roseola the color is a dusky red or venous, either from the beginning, or it soon becomes such.

CAUSES.—The delicacy of skin which infants possess is a cause of their liability to roseola. A common cause is the summer weather, and the derangements of the digestive system which

such weather is apt to occasion. It is more prevalent in one summer than another. It was especially frequent in New York city in the summer of 1868, when it was observed to be a not infrequent accompaniment of diarrhoeal affections. In general, the appearance of this eruption indicates mildness of the intestinal affection. The relation of roseola to variola and vaccinia has already been stated.

PROGNOSIS.—Roseola is always a mild and favorable disease.

TREATMENT.—This is simple. If roseola occur in connection with gastro-intestinal derangement or disease, the remedies which relieve the latter exert a curative effect upon the former. In all cases the state of the system should be inquired into, and any departure from a state of health corrected. Roseola needs no farther constitutional treatment. If there is itching or tingling of the surface, a lukewarm lotion, containing equal parts of liq. ammon. acetat. and mistura camphoræ, has been recommended, or a lotion containing a drachm of hydrocyanic acid to a pint of an emulsion of bitter almonds, used warm. The purpose of such lotions is simply to relieve the unpleasant sensation. Cold applications, or others which would repel the eruption, should be avoided; such an effect might be injurious.

CHAPTER II.

ERYSIPELAS—ECZEMA.

THE term erysipelas is applied to an erythematous affection, which is characterized by inflammation of the cuticle and subcutaneous cellular tissue, and by a tendency to spread. It is accompanied by a burning and pricking sensation, by swelling, and subcutaneous infiltration.

In rare instances, in young infants, an inflammation which has been designated erysipelas, occurs in and around the umbilicus. It commences about the time of the detachment of the umbilical cord, and is accompanied by redness of the skin, and tumefaction, and hardness of the cellular tissue surrounding the umbilicus. It usually causes ulceration of the umbilical fossa, and is fatal

case, pus is sometimes found in the umbilical vessels. This disease does not show any tendency to spread; the diameter of the inflamed surface is not more than three or four inches, with the umbilicus at the centre. It is generally fatal; but two favorable cases have been reported to me, in one of which there was considerable ulceration, and after recovery a firm cicatrix occupied the site of the umbilicus. The pathological character of this inflammation is not known; it can only be determined by more minute post-mortem examinations than have yet been made. The most reasonable view is that it is primarily an inflammation of the umbilical fossa and vessels, induced by uncleanliness, coebexia, or other cause. It lacks the distinguishing feature of erysipelatous inflammations, namely, the tendency to spread, and I shall therefore take no further notice of it in this connection.

Erysipelas seldom occurs in childhood; the few cases, which are met in this period, present nearly the same features, and pursue nearly the same course, as in the adult. In infancy, on the other hand, erysipelas is not a rare disease. Every practitioner is called to cases, from time to time. The following remarks relate to erysipelas occurring in this period of life. My views have been derived mainly from the records of cases which occurred in this city, some in my own practice, but most in the practice of other physicians. The points of chief interest in thirty-eight of these cases are embraced in the following table:—

Cases of Infantile Erysipelas.

No.	Sex.	Age.	Point of commencement.	Part affected.	Duration.	Result.
1	M.	2 months.	Right knee.	Entire surface, except face and scalp.	3 weeks and 4 days.	Recovered.
2	M.	3 years.	Left knee.	From a little above the knee to the ankle.	3 days.	Recovered.
3	M.	10 months.	Elbow.	Whole arm and forearm.	Recovered.
4	F.	1 year & 9 months.	Between right knee.	Entire leg, thigh, and trunk to the umbilicus.	7 days.	Recovered.
5	F.	9 months.	Vulva.	Abdomen, chest, and all the extremities.	10 days.	Recovered.
6	M.	7 days.	Cervix.	Both lower extremities, abdomen to the umbilicus.	6 days.	Dead.
7	F.	1 year.	Vulva.	Entire surface, except face.	4 weeks.	Recovered.
8	F.	6 weeks.	At or near the ear.	Forehead and side of face.	1 week.	Dead in 10 days; spasms.
9	—	6 months.	Epigastrium, to groin.	Trunk and lower extremities.	2 weeks.	Dead in 10 days; spasms.
10	F.	10 months.	At angle of mouth.	Entire face and scalp.	10 days.	Recovered.
11	F.	4 weeks.	Vulva.	Entire surface, except face.	7 weeks.	Dead.
12	F.	1 month.	Vulva.	Surface of abdomen to umbilicus and right lower extremity.	2 weeks.	Recovered.
13	F.	4 to 5 years.	Vulva.	All the limbs and the trunk, except the chest.	2 to 4 weeks.	Dead.
14	F.	1 month.	From erythema near crown of head.	Trunk and both lower extremities.
15	F.	1 month.	Vulva.	Entire trunk and both upper extremities.	5 weeks.	Recovered.
16	M.	8 months.	Face near ear.	Entire trunk and both upper extremities.	About 2 weeks.	Recovered.
17	F.	2 months.	Vulva.	Entire trunk and all the extremities.	1 week.	Dead.
18	F.	7 months.	Knee.	A portion of trunk and both lower extremities.	2 weeks.	Recovered.
19	F.	5 months.	Over the ear.	Entire face and forehead.	10 days.	Recovered.
20	M.	7 days.	Left wrist.	Left side of face.	3 days.	Dead.
21	M.	14 days.	Cervix.	Extended in lines, over abdomen to the chest.	4 days.	Dead.
22	M.	5 months.	Under chin.	Chin, left cheek, neck, left side of trunk, left thigh, and leg.
23	F.	2 years & 4 months.	Right shoulder.	Arm and forearm.	1 day.	Dead in 10 days; convulsions.
24	F.	10 to 11 days.	Vulva.	Body and all the limbs.	12 days.	Dead.
25	F.	7 months.	Crown left ear.	Back, chest and arms.	About 2 weeks.	Dead.
26	—	7 months.	Between right knee.	Trunk, neck, and head, and all the limbs.	2 weeks.	Dead convulsions.
27	F.	9 months.	Vulva.	Both thighs, and lower pelvic region.	7 days.	Dead convulsions.
28	M.	10 months.	Neck point of vaccination.	Shoulder, arm, and forearm.	21 days.	Recovered.
29	M.	4 months.	Neck point of vaccination.	Face, and both upper limbs.	2 weeks.	Recovered.
30	F.	2 months.	Neck vaccine scar.	Trunk, arm, and the limbs.	10 days.	Dead.
31	F.	1 to 4 years.	Neck vaccine scar.	Arm, forearm, and shoulder on one side.	2 to 3 weeks.	Dead.
32	F.	4 months.	Neck vaccine scar.	Arm, forearm, and hand.	2 months.	Dead.
33	M.	2 months.	Neck vaccine scar.	Upper entire surface.	1 week.	Dead with perforations.
34	M.	21 months.	Neck point of vaccination.	Arm and forearm.	Recovered.
35	M.	21 months.	Neck point of vaccination.	Arm.	7 days.	Dead probably of pneumonia.
36	M.	8 months.	Neck vaccine scar.	Arm and forearm.	11 days.	Dead.
37	—	4 months.	Left foot.	Leg, thigh, and lower part of trunk.	2 weeks.	Dead with paronychia.
38	—	4 weeks.	At outer ear.	Entire surface.	2 weeks.	Recovered.

AGE.—Of the above cases, 26 were under the age of six months; 9 from six months to twelve, and only 3 above the latter age. A large majority, therefore, of cases of infantile erysipelas occur in the first year of life.

POINT OF COMMENCEMENT.—In 50 cases in which I have ascertained the point of commencement, it was in 13 cases the vulva, 16 the arm after vaccination, 6 the leg; 5 the face, 3 the male genital organs, 3 at or near the ear, 1 the elbow, 1 the shoulder, 1 the nates, 1 the foot. In the adult, idiopathic erysipelas commonly commences upon the face, and affects only the face, ears, forehead, and scalp. On the other hand, in infantile erysipelas, statistics show that the rash commences upon the face only in a small proportion of cases, one in nine, and that it rarely extends to the face when it commences in other parts.

CAUSES.—In erysipelas the first departure from the healthy state occurs in the blood, or the system generally. This undergoes certain changes which predispose to erysipelas, or are sufficient in themselves to give rise to it. Among the causes which produce this state of system, uncleanliness, residence in damp, dark, and crowded apartments, and defective alimentation hold a principal place. Hence this disease is more common in the poor quarters of the city than in the country, and in dispensary and hospital, than in civil practice.

In a large proportion of cases there is a local exciting cause of the erysipelatous eruption, namely, an irritation or inflammation at some point, generally trivial, but which is sufficient to develop the disease in the system already prepared for it. It is very apt to commence at, or near a simple ecthymatous or impetiginous eruption, around burns or suppurating sores or syphilitic eruptions; it frequently commences, as is seen by the above table, near the point of vaccination immediately after vaccination, or when the pock is developed, or again when it has run its course, and been detached. In a considerable proportion of cases it commences at a point where the skin is thin and delicate, or where it unites with a mucous surface, probably from some uncleanliness or irritation of those parts. Thus, I have records of cases in which it commenced at the external ear, commissure of the mouth, and at the vulva. Indeed, the frequency with which it commences at the vulva renders female infants more liable

to it than males. In some instances erysipelas begins without any local exciting causes upon smooth and sound skin.

Vaccination, as an exciting cause of erysipelas, demands particular notice. Often, doubtless, it is the inflammation, which necessarily arises from the cut or the vesicle, which operates as an exciting cause of the erysipelatous affection, and not any deleterious property contained in the virus which is employed, so that an equal degree of inflammation occurring in any other way, as from a burn, would be attended by a like result. But facts show that the virus itself occasionally contains a latent noxious principle, which, introduced into the system, operates as a cause of erysipelas. Thus, a little girl was vaccinated by me in November, 1860, and, about the time when the vesicle began to fill, she was seized with severe inflammation of the fauces, attended by tædiation and infiltration of the submucous cellular tissue. The inflammation rapidly subsided, and, within a week from its commencement, the throat affection had nearly or quite disappeared. I now believe that the disease of the fauces was erysipelas, although it was not suspected at the time to have this character.

As the girl was otherwise healthy, and the vaccine vesicle passed through its usual stages, and presented the usual appearance, the scab was employed six weeks afterwards, to vaccinate two infants. Within twenty-four hours after vaccination both these infants were seized with high fever, ushering in severe erysipelas, commencing in one around the point of vaccination; in the other around syphilitic sores near the anus. In the former case the erysipelatous rash extended from the shoulder over the entire limb, and was obstinate, twice reappearing, and extending over the same surface; in the latter (a mulatto child) it extended over both lower extremities and a considerable part of the trunk, when the case passed into the hands of another physician, and the result is not known. The instrument with which the vaccinations were performed was clean. The vaccine disease did not appear in either of these cases.

Again, a well-known physician of this city vaccinated three infants, one his own (No. 32 of the table), with part of a scab which had been pronounced good, but was taken from a child that he had not seen, and with whose state he was not familiar. These infants were all affected with erysipelas from the vaccine

tion, his own dying. He had taken the precaution to rub the lancet on his boot before using it. Another physician of this city has informed me that he vaccinated two children in the same family with a scab, with all the precautions that he had ever used, and both were soon after affected with erysipelas of a severe form, extending from the point of vaccination; the vaccine disease did not appear. I know of no case in which the vaccine lymph gave rise to erysipelas, and, probably, it rarely or never does. In the lymph there is no admixture of foreign substances, whereas, in the scab, there is a large proportion of animal matter.

There is a form of erysipelas which occurs in the infant immediately after birth, and which is sometimes met in private practice: but is most frequently observed as an epidemic in lying-in wards. It is associated with severe, and commonly fatal, puerperal fever (metرو-peritonitis), or with erysipelas of the mother. This form of erysipelas is fatal almost without exception, and its contagiousness is generally admitted, whatever may be thought as regards the communicability of ordinary erysipelas.

A case showing this relation of erysipelas in the newly-born infant to disease of the mother occurred in the practice of Dr. Leaning, of this city. A lady gave birth to a healthy infant, on the 27th of July, 1860. Within a few days subsequently she was seized with a chill, followed by erysipelas, commencing on the thighs, and terminating fatally August 17th. No autopsy was made, and it is uncertain whether she had internal inflammation. A few days before her death the same disease commenced on the infant. It extended around the neck, upon the ears, down the arms, and terminated fatally August 24th. Erysipelas in the newly born, occurring in connection with erysipelas in the mother, is more rare than its occurrence in connection with puerperal fever. The records of lying-in asylums furnish striking examples of epidemics of puerperal fever, in which the infants of affected mothers perished of erysipelas.

The late Dr. Folsom, of this city, furnished me the following sketch of cases which occurred in his practice and that of his partner. "About the year 1840, being then in practice in New Bedford, Mass., I was called to visit a man who complained of pain in the knee. The next morning he was worse, but the following evening his symptoms grew worse, and as I was

engaged in a case of obstetrics, my partner, Dr. E. C., now dead, visited him. At my call, next morning, I unexpectedly found the patient dying. The disease was obscure, and at the autopsy next day no lesion was discovered. In making the examination Dr. C. pricked his finger, and experiencing little inconvenience from it at first, he attended a case of confinement on the following morning. A few hours subsequently he was taken sick, and I took charge of the lady, who died in three days, having the tumid abdomen and symptoms of child-bed fever. The infant of the patient was seized, when two days old, with erysipelas, appearing on the face and in spots on the trunk and limbs, and terminating fatally in one day. Dr. C.'s finger became swollen and painful, and the lymphatics of the forearm and arm became inflamed, presenting red lines, and the axillary glands suppurated. Though feverish and much prostrated, there was no appearance of erysipelas in his case. In about two weeks he resumed practice, and as at that time physicians in this country were not fully aware of the danger of communicating puerperal fever, he attended two, three, or four obstetrical cases each week, until the number reached fifteen. All the mothers died with symptoms of metro-peritonitis, and all the infants had erysipelas, commencing on the face or some part of the body, generally on the second or third day after birth, and in all terminating fatally within a week. This sad record was finally ended by the doctor's temporarily retiring from practice."

Dr. Condie, in his *Treatise on Diseases of Children*, says: "Erysipelas of infants very commonly occurs during the prevalence of epidemic puerperal fever. Children of mothers who become affected with the fever, are often born with erysipelatous inflammation; others are attacked almost immediately after birth. Whether, in these cases, the disease is to be referred to a morbid matter applied to the skin in the womb, or to the same epidemic or endemic influence which gives rise to the disease of the parent, it is difficult to say. According to M. Trousseau, infantile erysipelas is principally observed where puerperal fever prevails in the wards of the lying-in hospitals of Paris." In private practice it is rare that we meet erysipelas of the infant associated with erysipelas, or with puerperal fever in the mother. Some of the oldest physicians of this city, with whom I have conversed, and who are engaged in extensive general practice, state that they

have never met a case in which there was this relation. Cases like those observed by Drs. Folcon and Leuwing, would only occur when epidemic erysipelas or puerperal fever is prevailing.

PREMONITORY SYMPTOMS.—Infantile erysipelas in the majority of cases has no premonitory stage, or, if present, it escapes notice. Sometimes there are well-marked premonitory symptoms, as drowsiness, or restlessness, febrile movement, oppressed respiration, with perhaps vomiting, and starting or twitching of the limbs. In Cases 28 and 37 of the table, which occurred in my practice, the febrile movement, restlessness, and oppressed respiration were so great for three days before the appearance of the eruption, as to cause much anxiety. In the adult, pharyngitis often precedes the occurrence of the rash upon the skin. The same inflammation may be present in the premonitory period of infantile erysipelas, as well as during the period of erysipelatous eruption. The oppressed respiration, which is present in the commencement of some cases, is probably due to an erysipelatous turgescence of the bronchial mucous membrane.

SYMPTOMS.—The erysipelatous patient is usually restless, in consequence of the prickling or burning which accompanies the rash. In severe cases there is little sleep, night or day, except from medicine. The sleep is short, and is sometimes interrupted by sudden starting; convulsions may occur, but are not common.

Febrile movement is constant, and is proportionate to the extent and gravity of the erysipelas. I have notes of cases, in which the pulse was more than 200 per minute, although other symptoms did not indicate immediate danger. The skin not affected by the erysipelas is dry and hot, though not possessing the pungent heat of the inflamed portion; face often flushed, tongue moist, and covered with a light fur, stomach usually retentive. The state of the bowels varies; sometimes they are regular, sometimes variable, while in other cases the stools are green, and more frequent than natural. I have records relating to the state of the bowels in twenty cases, as follows: in seven, regular; in six, loose; in two, constipated; in one, constipated, then loose; and in one, constipated, then regular. Diarrhoea, when present, is usually mild, requiring little or no treatment. The rash does not in all cases have such a deep red color as in the adult, but otherwise there is nothing peculiar in its appearance; in feeble infants, with an impoverished state of the blood, its color is pink, instead of the

deep red, which characterizes the inflammation in the robust, vesication may occur as in the adult, and subsequently the same desquamation and oedema.

If the infant is debilitated, there is great danger of the formation of abscesses, around which the inflammation lingers, after it has disappeared from every other part of the body. Sometimes also, in very young infants, gangrene occurs, especially of the genital organs in the male. Several of these cases have been related to me, all under the age of a month or six weeks, and all fatal. Occasionally the sloughing is so great as to denude the testicles. A noteworthy feature of erysipelas in infants is its proneness to return. When it has been progressively subsiding, and hope is entertained of its speedy disappearance, it is not unfrequently suddenly relighted from unknown causes, travelling again over the same, or parts of the same surface. In one case, the disease arising from vaccination extended three times over the arm and forearm, and in another case a second time over both legs, and a considerable part of the trunk.

The internal inflammations, which most frequently accompany erysipelas, and give rise to symptoms which are conjoined to those which pertain to the erysipelas, are pharyngitis, and peritonitis; more rarely broncho-pneumonia or enteritis occurs. In a case which I examined after death, in the Nursery and Child's Hospital, and in which the erysipelatous inflammation had extended over the abdomen, the lesions of peritonitis were discovered, and from the thickness of the abdominal walls it seemed probable that there had been an extension of inflammation from the skin to the peritoneum.

Prognosis.—Erysipelas is much more fatal in infancy than in adult life. In the death statistics of this city for three years, I find eighty deaths from erysipelas of infants under the age of one year, to eighty-three deaths from this disease above that age. Age greatly influences the prognosis. Infants under the age of three weeks nearly all die; from the age of three weeks to six months the result is doubtful; while above the age of six months a majority recover with correct treatment. It will be seen by the foregoing table that seven infants under the age of six weeks had erysipelas, and six died; from the age of six weeks to six months, six recovered and nine died, and above the age of six months, nine recovered and four died.

With the exception of a case of the so-called umbilical erysipelas, the youngest child who recovered, of whom I have obtained information, was three weeks old. In this case the rash extended nearly over the entire surface, beginning with the face. Case 88 of the table, treated by myself, was very similar as regards the extent of the erysipelatous eruption and the result. This infant was five weeks old.

It is scarcely necessary to state that erysipelas is more favorable when it affects the limbs than when it invades the head, neck, or body; when it spreads slowly than rapidly; when it is superficial than when phlegmonous. In those cases in which the cellular tissue is much involved, the infant is not always safe after the disease has run its course; he sometimes dies exhausted from the discharge of abscesses; I have records of two such cases.

DURATION.—In fourteen cases that recovered the disease terminated within the first week in two, the second week in six, the third week in four, and in two cases it lasted five and six weeks. The average duration was fifteen days. In eighteen fatal cases ten died within the first week, five the second week, three the third week, and one in the fourth week. The average duration of fatal cases was about ten days.

MODES OF DEATH.—Death occurs in different ways; in clonic or tonic convulsions followed by coma, from exhaustion, and from internal inflammation. The most common mode in the cases, of which I have records, was exhaustion.

PATHOLOGICAL ANATOMY.—The blood doubtless in this disease undergoes certain pathological changes in most cases prior to the occurrence of the eruption, but the exact changes are not known. Our knowledge of the morbid anatomy of erysipelas relates chiefly to the local affections which, with the exception of the inflammation of the skin, are not constant, and may, therefore, be regarded as complications. The cutaneous inflammation affects all the structures of the skin, and in greater or less degree also the subcutaneous cellular tissue. The inflammation is accompanied by more or less serous effusion or oedema.

The not infrequent occurrence of peritonitis in connection with erysipelas has long been known. In Heberden's *Essays Medico-rum Præcipuum*, the anatomical character of erysipelas is expressed in one sentence. "When the body has been opened after death the intestines have been found glued together and covered with

coagulable lymph." Since Heberden's time nearly all, who have written on diseases of infancy and childhood, have mentioned peritonitis as one of the most common complications. Underwood says: "Upon examining several bodies after death the contents of the body have frequently been found glued together and their surface covered with inflammatory exudation, exactly similar to that of women who have died of puerperal fever." Similar remarks in reference to the frequency of peritonitis, in this disease, are made by recent writers.

The fact in reference to this complication probably is, that in young infants in hospital practice, and in infants affected by erysipelas during epidemics of puerperal fever, peritonitis is a not infrequent complication. On the other hand, as we commonly meet cases of infantile erysipelas occurring sporadically in private practice, there is not sufficient abdominal distension and tenderness for peritoneal inflammation. In only one of the cases embraced in the foregoing table was a post-mortem examination made, and in that there had been no peritonitis. The occurrence of pharyngitis in connection with erysipelas has been already alluded to.

Enteritis is another not infrequent complication in infants. Diarrhoea has been stated to be a symptom in certain cases; it has been found to be dependent on enteritis of a mild grade. Billard made post-mortem examinations of sixteen cases of infants dying of erysipelas, and "found in two gastro-enteritis, in ten enteritis, in three pneumonia complicated with enteritis and cerebral congestion, and in one pleuro-pneumonia."

TREATMENT.—On this side of the Atlantic great uniformity prevails as regards the treatment of erysipelas. Sustaining measures are proscribed, and the tincture of the chloride of iron is the tonic generally preferred. Whatever the intensity of the febrile reaction and the stage of the disease, if there is no intestinal complication, ferruginous or other tonics should be administered. The largest doses of the tincture of the chloride of iron given in any of the cases in the above table was in case No. 4, namely, ten drops every two hours, and this patient recovered in seven days from a pretty severe attack. Probably, however, nothing is gained by such large doses, and they may irritate the intestinal surface, and increase the liability to enteritis, which we have seen complicates a certain proportion of cases. Two drops may

be given every three hours, to a child from one to two years of age. Instead of the iron, or in addition to it one of the preparations of cinchona may be prescribed. Beef-tea, and in most cases wine whey, or other alcoholic stimulant, is required.

The depressing measures recommended by certain writers cannot be too strongly censured. Bouchut says: "We should endeavor from the first to allay the inflammation of the skin by energetic treatment. . . . Local abstraction of blood, by means of one or two leeches applied at the circumference of the primary seat of the erysipelas, should be put in force, provided the power of the constitution of the children permits." Such treatment may explain one of Bouchut's aphorisms, namely, *the erysipelas of infants is a fatal disease*.

Local treatment designed to arrest the extension of the inflammation is in most cases ineffectual. Solid nitrate of silver was employed in two cases, of which I have records, and in both the result was pernicious. Troublesome sores were produced, from which blood escaped, and in one of the cases, at least, death was attributed by the parents to this treatment rather than to the disease.

Tincture of iodine may be safely employed to arrest the extension of erysipelas. It should be applied from the margin of the inflammation, over the sound skin, to the distance of about two inches. It may be ineffectual, but it does not produce any unfavorable result. Soothing applications, like rye flour, or a lotion of sugar of lead, may be made to the inflamed surface, as in erysipelas of the adult.

ECZEMA.

Eczeema is a common, non-contagious exanthem. In its typical form it presents numerous minute vesicles upon a patch of irregular shape, and usually of considerable size. The vesicles are often ruptured, but in other cases their contents are absorbed. Commonly, a moist, excoriated surface results, which is soon covered by a thin crust.

Eczeema has received the names *faciei*, *capitis*, *aurium*, &c., according to the localities in which it occurs. Often many of the eruptions are pustular, as in *impetigo*. The secretion is then abundant and semipurulent, and a thicker, more yellowish scab

results than in the ordinary form of eczema. Eczema presenting this modification is designated impetiginodes.

Eczema is common at any period of infancy; it sometimes commences at the age even of two or three weeks. Its usual cause is some error in the digestive process. Occurring in nursing infants, it is attributable to the inferior quality of the mother's milk, or to some deleterious property contained in it. Disease in the mother, or temporary derangement in her health, often manifests itself in the nursing, by the occurrence of this disease.

SYMPTOMS.—In infants affected with this disease there are often other forms of cutaneous eruption upon different parts of the surface, as erythema, strophulus, lichen, and psoriasis. The prevailing character is, however, seen to be eczema.

There is great difference in different instances, as regards the state of eczematous children. Some appear to be in good general health, with the exception of softness or flabbiness of their tissues; others, though fleshy, are pallid, or have a strumous appearance, while others still are emaciated, and in decided ill-health. There are usually no marked evidences of gastro-intestinal derangements, except such as are present in simple indigestion. The alvine evacuations are sometimes green, or unhealthy looking.

Eczema commences as a red patch, with a cluster of minute pimples, which increase and become vesicular, and most of them are then broken by the scratching on the part of the child which the itching provokes. A thin, watery-looking discharge follows, which is more or less abundant; it may be scanty, or it may be so abundant, as to wet through the linen, which is applied over it. The patch gradually enlarges. Its extension may be due in part to the irritating character of the discharge, which flows more or less over the surrounding surface.

In the mildest form of eczema the moisture dries into a thin semi-transparent, amber-colored scab. If pustules have been developed, the pus mixed with the eczematous discharge, produces a thicker, yellowish, and opaque scab. The scab usually breaks in places, and through the fissure a transparent liquid oozes, or a liquid mixed with more or less pus, or if the surface is bruised, or otherwise injured, with blood. Old crusts usually have a lighter color than those more recently formed. The most common seat of this disease in infants is the scalp, and next in frequency the face; it also occurs not unfrequently upon the chest, and in the

flexures of the joints. The crusts are usually thickest upon the scalp, partly because the discharge is retained by the hairs, partly because, in this situation, eczema impetiginodes is apt to occur.

This disease, when recent, is accompanied by considerable swelling of the integument; if it occur within, or around the external ear, this is swollen, and it gives rise in this situation to a pretty abundant watery discharge; if the disease occur upon the features, they are swollen. Frequently the lymphatic glands in the vicinity of the eczema are tumefied.

Eczema, without treatment, is apt to be protracted. It may become chronic, and then it changes its character. It is no longer a moist, but dry eruption; it becomes psoriasis or pityriasis.

When eczema is protracted, the general health becomes more sensibly impaired than at first.

DIAGNOSIS.—Eczema may be mistaken for scabies, especially if it is seated on parts which scabies is apt to affect. The eruption in eczema is in clusters, in scabies, isolated; inflamed patches do not occur in scabies; in scabies the vesicles are pointed, in eczema, flattened or round. By careful examination the furrow produced by the acarus in scabies may be discovered, and even sometimes by the microscope the acarus itself.

The vesicles in scabies are isolated, and much larger than in eczema.

The diagnosis of chronic eczema involves considerable difficulty, but by careful examination traces of the characteristic eruption may often be seen at the margin of the patch.

TREATMENT.—This disease requires both internal and local treatment. In most recent cases, and in all cases attended by much inflammation and pruritus, great benefit is derived from an occasional purgative dose. This is one of the few diseases in which calomel is useful, given in occasional purgative doses. By its derivative effect, it diminishes the intensity of the cutaneous inflammation, and relieves the pruritus. Treatment may be commenced by a dose of calomel, and if it do not have a purgative effect, a dose of castor oil, or syrup of rhubarb may be administered subsequently. The dose for infants should be from one to three grains according to the age. In feeble infants it should not be given, or the hydrargyrum cum creta may be given in its place. The calomel should not be administered often: once or twice weekly suffices. "In my own practice," says Wilson, "I

usually find cure a week sufficient, and I am guided to the repetition of the dose by the state of the little patient. If there be any feverishness, fractiousness, irritability of temper, any increase of pruritus, inaction of the bowels, morbid secretion of the bowels, or threatened congestion of the mucous membrane of the air tubes, then the calomel powder is to be administered at once, without hesitation, and without delay. The mother or nurse soon learns the moment for a powder, and whatever prejudices they may have to the name of calomel, they are always ready to resort to it, after they have once seen its action in this disease.¹¹

The eczematous eruption always requires local treatment. The medicinal agent employed for this purpose, which more than any other commands the confidence of the profession, is the oxide of zinc. The benzoated oxide of zinc ointment, rubbed down with spirits of wine, is recommended by Wilson. The two substances are not, however, miscible. The ointment may be used alone. It should be applied twice or thrice daily, and should not be washed off, nor should water be applied to the eruption. The discharge from the inflamed surface should be removed by a soft cloth. If the location of the eruption is convenient, linen may be smeared with the ointment and applied to it. In cases of *eczema capitis*, an oil-silk cap is convenient, and useful to retain the ointment.

If the inflammation is mild, and especially if the disease has continued a little time, I prefer the following lotion:—

R.—*Pulv. camphoræ* ℥i;
Pulv. zinc. oxid. ℥ss;
Glycerina ℥i;
Spts. rosarum ℥i.
 Mice.

This should be used in a similar manner to the zinc ointment. The camphor is useful in relieving the pruritus; camphor water may be applied for this purpose in the acute and most inflammatory forms of the disease, as well as in the subacute.

I have observed good results from an ointment of tannic acid and stramonium:—

R.—*Acid. tannic.* ℥i;
Ung. stramonii ℥ss;
 Mice.

A very important part of the treatment of eczema is the employment of remedies to restore the general health, if it is at all

impaired. Tonics, vegetable and ferruginous, and cod-liver oil are useful in different cases as restoratives. We have, in addition, one internal remedy, the value of which is acknowledged by almost all dermatologists, namely, arsenic. Wilson calls it a specific for this disease. He prescribes Fowler's solution in the following formula:—

R.—Vial ferr.
Syrup balsam. aa. ℥ss.
Liq. potas. arsenic. ℥xxxj;
Aq. destil. ℥i.
Mise.

Dose, one dessert-spoon, with or after the meals, three times daily.

He gives of the liquor potasse arsenicæ "two minims to an infant from a month to a year old, repeated three times in the day, with or directly after meals; and as mal-assimilation is always attended with anæmia, in a greater or less degree, I conjoin with the two minims of Fowler's solution fifteen of vinum ferri."

Scabies.

Scabies is a vesicular eruption; it is attended by great itching, which is increased by warmth; it is, therefore, most intense when the child is covered in bed, and also after the use of stimulating drinks.

This eruption is due to the presence of an animalcule which resides in the epidermis, where it burrows in channels and excites inflammation of the surface of the derma. This animalcule is the *scarus scabiei*. It is not only the cause of the vesicular eruption, but it produces more or less scaldiness of the skin. The vesicles are isolated, and not numerous, and they vary somewhat in form, according to their location. Between the fingers they are conical and pointed, while in certain other situations they are less acuminate and even rounded. The contents of the pointed vesicles are clear, like water; those of the rounded vesicles are usually also transparent, but frequently more or fewer of them have a degree of opacity, from the presence of pus cells.

If the vesicle is recent, we are sometimes able, by careful examination, to detect the minute channel in which the *scarus* has burrowed. This channel is termed the *cuniculus*. It is five or six lines in extent, and can be traced by its whitish appear-

ance. The animalcule resides at the end most distant from the vesicle. It appears as a minute dark point, and may be removed by a needle.

There is no communication between the vesicle and the cuniculus, and there are many vesicles without cuniculi. The portion of the skin which is most frequently affected by scabies is that between the fingers. Commencing with the fingers, it extends along the back of the hand to the wrist, flexures of the elbow, axilla, and trunk. In nursing infants, who contract it from wet-nurses, it frequently appears, first, upon other parts.

The itching in this disease is intense, especially when the infant is covered warm in bed, or the surface is heated. If the vesicles are broken, as is common from the scratching, they become covered with thin scales, produced by desiccation of their contents. The color of these minute crusts is yellowish, or, if blood has escaped from any of the capillaries, dark. In feeble children scabies commonly spreads slowly, or it remains limited to a small part of the skin. If, on the other hand, the child is robust, with a full and active cutaneous circulation, the disease spreads more rapidly. As scabies is due to the presence of an animalcule in the epidermis, it exhibits no tendency to a spontaneous cure. It is very protracted, unless proper remedial measures are employed.

DIAGNOSIS.—Correct diagnosis is important, because the treatment required is different from that in any other exanthem, and because the suspicion of having this disease always renders one solicitous to know his exact state. Scabies may be distinguished by the vesicular character of the eruption from all other exanthematic affections except eczema, sudamina and herpes. Eczema is most common on the scalp and face, where scabies does not occur, and unlike scabies its vesicles are round and thickly aggregated in clusters; in eczema there is a smarting or pricking sensation very different from the intense itching of scabies. In herpes the vesicles are large, rounded, and in clusters, and attended by a burning, or pricking sensation, with but little itching. The eruption in sudamina is vesicular and discrete, but it is globular, and accompanied by no itching or other local symptoms.

TREATMENT.—As scabies is due to a species of acarus which burrows in the epidermis, it can only be treated successfully by measures which destroy this animalcule. If it is destroyed, the

disease gets well of itself. Sulphur has been employed for a long period for this purpose, since sulphurous acid, which is evolved from the sulphur, is destructive to the animalcule. The unguentum sulphuricæ, if thoroughly applied, will rarely fail to eradicate the disease. The internal use of sulphur aids the external treatment, since a portion of the gas which is generated escapes through the pores of the skin. The chief objection to the employment of sulphur is its exceedingly unpleasant odor, which is noticeable, however disguised by perfume. Sulphur, or any other substance employed externally, has more effect if it is preceded by a bath, which softens the epidermis, and therefore favors the entrance of the sulphur into the pores of the skin, and the cuniculi.

Helmerich's ointment is very effectual in the treatment of scabies. It consists of two parts of sulphur, one of carbonate of potash, and eight of lard. "M. Hardy afterwards perfected the method so as radically to cure the disease in two hours. He proceeds in the following manner: The patient first undergoes a friction of his whole body for half an hour with soft soap, in order to cleanse the skin and break up the burrows; a warm bath of an hour's duration follows, during which the skin is thoroughly rubbed, in order to complete the destruction of the burrows; after which frictions for half an hour, and upon the whole surface are practised with Helmerich's ointment. This completes the cure. Out of four hundred patients subjected to this treatment, only four returned to the hospital." (*Stille's Therapeutics*, &c., vol. ii. page 516.)

M. Albin Gras experimented with different substances, in order to ascertain their relative destructiveness to the acarus. The following table gives some of the results of his experiments:—

Immured in pure water the acarus was alive after three hours.		
"	saline	" moved freely after three hours.
"	Goulard's solution	the acarus lived after one hour.
"	olive, almond, or castor oil	the acarus lived more than two hours.
"	lime-water	the weasels died in three-fourths of an hour.
"	vinegar	" " twenty minutes.
"	alcohol	" " " "
"	turpentine	" " nine "
"	iodide of potassium	the acarus died in four to six minutes.

It is seen that vinegar, lime-water, alcohol, turpentine, and iodide of potassium destroy the acarus in a short time. They may

be employed in the same way as the sulphur ointment. Canthar also destroys the acarus. It may be employed in sweet oil for this purpose. When the acarus is destroyed, and the local disease is cured, tonics are sometimes required to restore the general health.

SECTION VI.

DISEASES OF CIRCULATORY SYSTEM.

CHAPTER I.

CYANOSIS.

IN 1843, I read before the New York Academy of Medicine a statistical paper on cyanosis, which was published in the Transactions of that Society. This paper contains an analysis of 191 cases, collated from the various European and American medical journals, and to these cases I am indebted for most of the following facts pertaining to this disease.

The term cyanosis, or blue disease, is differently employed by writers. Some apply it to cases of transient lividity, occurring in the course of acute diseases, as well as to those cases, which depend on permanent structural changes, or on malformations. I apply this term, as do most pathologists, only to the latter cases.

Some are inclined to discard the consideration of cyanosis as a disease, regarding it rather as a symptom. Their view is, in my opinion, correct in reference to the cyanotic state, which occurs in certain acute diseases, but not in reference to cyanosis, as I have defined the term and employ it. The propriety of considering cyanosis a disease is more apparent if we are not misled by the term which designates it. Lividity is not its most important or its essential characteristic. It is simply a sign, although conspicuous, and, indeed, the only one by which the disease can be readily recognized. Cyanosis is, in reality, a

blood disease, its pathological state consisting in a deficient oxygenation of this fluid, or in an excess in it of carbonic acid, and probably of carbonaceous products. It should be placed in the same category with leucocythæmia and melanæmia.

Statistics show that cyanosis is, with very few exceptions, due to malformation in the circulatory system, and at the centre of circulation, namely, in the heart and in the large vessels which arise from this organ. In the exceptional cases, the cause of the cyanosis is located in the lungs, and is in all or nearly all instances either extensive emphysema in both lungs, firm and thick fibrinous exudation over both lungs, compressing them by its contraction and causing perhaps carnification in parts of them, or the cause is compression of the lungs from curies of the vertebrae, and consequent depression of the ribs. These causes pertain to youth and manhood, rather than to infancy and childhood. On account of this fact and the rarity of such cases they need not be considered in this connection.

Literature of Cyanosis.

The ancient physicians, so far as can be ascertained from their writings still extant, were ignorant of cyanosis; whether they overlooked it, or whether those early ages were exempt from it, and the malformation on which it depends is peculiar to a posterity physically degenerate. The blue disease described by Hippocrates (*De Morbis*, lib. ii. sec. v., page 485, Ed. de Foes, 1621) was probably some acute febrile affaction. Galen, whose voluminous writings, with an excellent index, are still extant, and whose comprehensive mind embraced the whole range of medical science of the second century, makes no mention of it, so far as I can find. In the middle ages, as appears from a remark of Boerhaave (*Dissert. of the Hæmorrh. Acad. Lect. § 782*), the common people believed the cyanotic to be the victims of evil spirits; and it is probable that physicians, during this long period of superstition and intellectual lethargy, embraced the popular belief.

On the revival of learning, pathological anatomy began to be more thoroughly and intelligently studied; but it is evident that before the great discovery of Harvey, in the 17th century, it was impossible to refer cyanosis to its true cause. In the latter part

of the century so auspiciously opened by Harvey's genius, malformations of the heart were observed and described by some pathologists on the Continent in cases in which cyanosis must have been present; but it is uncertain, from the brief records which they have left, whether any of them understood the dependence of this disease on the abnormal state of the heart. Boerhaave, in the beginning of the eighteenth century, attributes "a livid or black color diffused throughout the whole skin," evidently referring to cyanosis, to "1, a relaxation of the vessels, while the *vis a tergo* remains the same, or, 2, to a too sudden increased pressure behind, without a relaxation of the vessels." Vieussens, who was a contemporary of Boerhaave, and was more thorough in the examination of morbid as well as healthy structures, narrated the history of a cyanotic patient, with a description of the malformation. But the one who first gave particular attention to the blue disease was Morgagni. This Paduan professor, far excelling his predecessors in thoroughness of observation and accuracy of deduction, published a theory in explanation of the disease which now, after the lapse of more than a century, has many adherents. In the same century with Morgagni, the eighteenth, but subsequently to his time, Dr. Pulteney, Wm. Hunter, Baillie, Wilson, and Abernethy in Great Britain, and Jurne and Sandifort on the Continent, may be mentioned among those who contributed to a knowledge of cyanosis by the publication of cases, with a description of the malformations. Yet, when the present century commenced, no monograph or dissertation had appeared on this disease; and notwithstanding the publication of cases from time to time, the profession, generally, were almost totally unacquainted with its nature. No better idea can be given of the prevailing ignorance in reference to cyanosis at this period than by quoting from a case, narrated by Ribes in 1814. (*Bull. de la Fac. de Méd. Paris, 1813*.) The patient had some time previously received an injury of the finger. "Many physicians of Amsterdam," says he, "were at different times consulted on the subject of this affection, no one of whom understood its true cause, its essential character. One considered it as partaking of the nature of epilepsy, and caused by the irritation in the nervous system which the wound in the finger had produced. Others attributed it to the presence of intestinal worms. Some physicians pronounced it an injury of the liver or spleen. Many held

it to be a scorbutic affection. One only believed it to be the result of an unknown organic disease."

Since the commencement of the present century the blue disease has received a large share of attention. According to Forbes's *Medical Biography*, the first dissertation on this subject appeared in 1806, from the pen of Seifer, and from this time till 1832 no fewer than twenty-eight dissertations or monographs were published, either on cyanosis, or on malformations, which produce it or at least relate to it. In the list of writers are some of the most eminent names in the profession, as Louis and Bonil-laud. The number who have written on this subject since 1832 probably exceeds the number of previous writers. Of those who have contributed most to our knowledge of the disease may be mentioned Farre, Chevers, and Peacock in Great Britain, Gintrac on the Continent, and Moreton Stillé in this country. Farre, Chevers, and Peacock wrote on malformations of the heart, alluding incidentally to cyanosis, but their writings contain valuable matter for statistics bearing on the latter subject. Farre's book was published in 1814, and is out of print; Chevers published his papers in the *London Med. Gazette*, commencing in the year 1845 and running through several successive volumes. Peacock's *Treatise* was published in 1838. It contains several original cases, previously narrated by him to the London Pathological Society. The paper by Moreton Stillé, which has attracted much attention, especially in Europe, was his Inaugural Thesis, and was published in the *Ann. Journ. of Med. Sci.*, in 1844. This paper relates entirely, in the words of the author, to "the laws of the causation of cyanosis." The only really complete statistical paper on the blue disease is that by M. Gintrac, published in 1824, in Paris, and embracing all the cases, which had been accurately reported up to that time, namely, fifty-three. He, indeed, exhausted the subject for the period in which he wrote, and were it not for the vast accumulation of material since, little could be added to his essay.

Two theories in explanation of the occurrence of cyanosis have divided the profession; the one attributing it to obstruction at the centre of circulation, and consequent venous congestion; the other, to admixture of venous and arterial blood through openings in the septa of the heart, or through the ductus arteriosus. The former of these theories originated with Morgagni more than

one hundred years ago, and is essentially the same as that advocated by Stillé. Stillé errs in placing Morgagni among the advocates of the other system. The second theory, or that which attributes cyanosis to admixture of venous and arterial blood, is said by Dr. Peacock to have originated with Hunter, but its ablest supporter was Gintrac. Of late there are some pathologists, who do not believe that either theory is sufficient to explain the cause of cyanosis, and that the true explanation lies somewhere between the two. Among the most conspicuous of these is Prof. Walke, of London. These theories will be considered in the proper places.

SEX.—Writers on cyanosis state that there is a preponderance of males to females affected with it. Aberle, of Vienna, says that two-thirds were males in an aggregate of 180 cases which he collated. In Gintrac's cases 28 were males and 16 females; in Stillé's, 41 were males and 31 females. The sex is recorded in 134 of the cases collected by me, of which 78 were males, 56 females; and if those cases are excluded in which cyanosis was due to obstruction at the mouth of the pulmonary artery, the number of the two sexes is the same. In the five years commencing with 1858, according to the mortuary returns, 207 died in this city from cyanosis, of which number 117 were males, 90 females. In England, for two years, 418 males died of cyanosis, and 273 females. Although statistics of different cities and countries agree in the fact of an excess of males over females, there does not appear to be that great preponderance of males, which the earlier writers on this disease believed to exist.

CAUSES OF THE MALFORMATIONS.—Mothers sometimes attribute the malformations, and probably correctly, to strong mental impressions felt during ætero-gestation. The mother of a patient treated by Dr. Peacock stated that, "two months before her confinement, she was frightened by seeing a child killed, and never recovered from the shock she sustained." (*Mem. of Hart*, p. 87.) In another case "the mother was much out of health, and stated that, when pregnant with the child, she was greatly alarmed by seeing a man who was dying of asthma," (*Op. cit.*, page 57.) In another instance the mother was frightened at the fifth month of pregnancy (page 41); and in still another case, recorded by Dr. Peacock, the mother, four or five months before her confinement,

"was greatly alarmed by her husband, who was insane, standing over her, for two hours with a loaded pistol." (page 43.)

Occasionally the malformation appears to be due to some vice or taint in the system of one or both parents. In a case quoted in the *Gazette Médicale* for December 28, 1859, from another continental journal, it is stated that "the mother, who had formerly suffered from rickets, gave birth to five children, all of whom died immediately or shortly after birth with symptoms of cyanosis. The father died at the age of thirty-six of phthisis." Dr. Pesceok relates a case in which the father was livid, and had the "pigeon-breast" common in the cyanotic. In the history of a patient, which was communicated by Cooper to Farré (Case 166), it is related that "vices of conformation of the heart appeared to have been inherent in the family. Of 12 infants only 4 survived, and more presented signs of heart-disease." Dr. Buchanan relates the history of a child which was the second that had suffered and died in the same family in the same way (Case 40). A patient treated by Mr. Leonard was the sixth child of the family, who had died at about the same age, with symptoms of cyanosis. Such instances are, however, exceptional. Ordinarily, the cyanotic have not only healthy parents but healthy brothers and sisters.

A patient whose history is given by Dr. William Hunter, was born at the eighth month, but in nearly all other cases the full period of uterine existence was reached.

The opinion was expressed by Guitrac that the number affected with cyanosis, to the entire population, varies in different countries. It is probable that the occurrence of the blue disease is not greatly, if at all, influenced by the nationality, but it is certainly dependent to a considerable extent on the condition of society. It is less frequent in a community in comfortable circumstances, and engaged in wholesome and quiet occupations. Pure air and outdoor exercise, plain, nutritious diet, freedom from cares and anxieties, in fine, causes which promote the physical well-being, diminish the liability to an ill-formed and cyanotic offspring. And, conversely, impure air, improper and insufficient diet, grief, etc., increase the percentage of cyanotic cases. Hence it is a rare disease in the rural districts, and comparatively frequent in the cities, especially in a large city like New York, which contains a numerous, indigent, and careworn population, living from year to

year in the midst of agencies which operate stealthily but certainly to enervate the system and undermine the health.

These remarks are abundantly substantiated by statistics. In New York City, for the six years ending with 1860, there was one death from cyanosis to 436 deaths from all causes; and in Brooklyn the proportion estimated for two years was about the same. On the other hand, in the State of Kentucky, which contains few large cities, and in the death reports of which cyanosis is included in the general term malformation, there was, during a period of five years, one death from malformation to 2468 from all causes. In the State of South Carolina, for three years, there was one death from cyanosis to 3018 from all causes. In the State of Massachusetts, for two years, there was one death from cyanosis to 1136 from all causes, and two-thirds of the cyanotic cases occurred in the counties of Suffolk, Essex, and Worcester, which contain large cities. In London there was one death from cyanosis to 755 from all causes during a period of three years. On the other hand, in England, including the city of London, there was, for the ten years ending with 1837, one death from cyanosis to 1583 from all causes; and in the rural districts of Monmouth and Wales there was only one death from cyanosis to 5578 deaths from all causes during a period of two years.

TIME OF COMMENCEMENT.—It is an interesting and somewhat remarkable fact that cyanosis, though dependent on a malformation, does not always commence at birth, or, at least, that it does not exist in degree sufficient to produce the cyanotic hue till some time has elapsed after birth. In 135 of the cases of cyanosis which I have collected, the time at which lividity was first observed is stated as follows: In 97 it was within the first week, and generally within a few hours of birth. In the remaining 38 cases it commenced as follows:—

In 3 at 1 week.	In 6 from 2 years to 3 years.
" 1 " 2 "	" 1 " 5 " " 10 "
" 2 " 1 month.	" 3 " 12 " " 20 "
" 7 from 1 to 2 months.	" 1 " 20 " " 40 "
" 3 " 2 " 6 "	" 1 over 20 years.
" 5 " 6 " 12 "	—
" 2 " 1 year to 2 years.	41

In these 41 cases, in which disease did not occur till after the age of one week, if the patient were less than two years old when

it commenced, there was frequently no obvious exciting cause, but above this age, with three exceptions, such a cause is known to have been present. It is interesting to observe how trivial the exciting cause frequently is, and equally interesting to note how long patients have enjoyed good health, not having the least lividity, although the anatomical vice, to which the final development of cyanosis was due, had existed from birth.

Dr. Theophilus Thompson relates in the *Medico-Chir. Trans.*, vol. xxv., the history of a lady, thirty-eight years old, who was well till an attack of Asiatic cholera, after which her health was permanently impaired. Two years before her death she passed through a course of fever, and from this time was cyanotic. In the *Philadelphia Med. Examiner*, June 1850, Dr. Waters relates a case, in which cyanosis began at the age of six years in an attack of measles. In a case published by Mr. Napper, in the *London Medical Gazette*, 1841, the child fell at the age of six months, and from this time had cyanosis. A female, whose history is given by Prof. Tommasini, of Bologna, and quoted by Bouillaud, became cyanotic at the age of twenty-five in consequence of difficult parturition. In the *London Lancet*, 1842, Mr. Stoolman relates a case, in which cyanosis began at the age of ten weeks in an attack of convulsions. In the *American Journal of Med. Sciences*, 1847, Dr. John P. Harrison published the history of a baker, twenty years old, in whom cyanosis began five years previously after great effort in carrying wood. Louis and Bouillaud quote from M. Caillot the case of a child, who became cyanotic at the age of two months in an attack of hooping-cough. Louis also narrates a case in which hooping-cough had the same effect at the age of twelve years. Ribes treated a child in whom the blue disease began at the age of three years from a severe contusion of the fingers. In a case related by Marx it commenced at the age of ten months from a blow on the back, inflicted by the mother. In the *Medical Times and Gazette* for 1863 Mr. Spurr gives the history of a female, who at the age of thirteen years was put in a place requiring considerable exertion, and from this time was cyanotic. A patient, whose case is narrated by Cherrier, fell into a deep ditch in the winter season, and immediately after had a low fever, from which the blue disease commenced. In a case published by Taccoue the exciting cause was believed to be fright, in consequence of a fall from a great height, and in another, related by

Bonilland, it was a blow received on the epigastrium after the patient had passed the age of fifty years. Similar cases are related by Mayo and Peacock.

It will be seen that the exciting cause of cyanosis is usually such as produces a profound impression on the system, and affects the action of the heart. Precisely in what way it operates to develop the disease has not been satisfactorily explained. Mr. Mayo conjectures, that in the case related by him there was previously some compensation which ceased, or became inadequate in consequence of some change produced in the economy. Although cyanosis may not appear for months or even years, there is rarely improvement when it is once established. Appearances of amendment are deceptive. The disease when not stationary is progressive, and this explains the fact, that few survive the middle period of life.

SYMPTOMS.—The symptoms of cyanosis vary in intensity in different patients, and in the same patient at different times, being milder if he is quiet and the mind calm, more severe if active, or if the mind is agitated. In mild cases, in a state of rest, they nearly or quite disappear, so that a stranger would not suspect that there was any serious ailment. They are aggravated by any cause, which accelerates the action of the heart. In some, cyanosis is increased by the most trivial disturbing influences, among which may be mentioned nursing, dentition, crying, coughing, and slight emotions of joy, sorrow, or anger. In more than one case it has been perceptibly increased by the stimulus of digestion, the color being deeper after a full meal than before.

The cyanotic hue varies in different individuals from duskliness to a deep purple, almost black color. It is usually most marked in the visage, especially the palpebre, cheeks, nose and lips, in the ears, fingers, and toes, and upon the mucous surfaces. It is sometimes, without any assignable cause, confined to a portion of the body. In a case related by Mr. Steel, in the *London Lancet*, 1838, the upper part of the body was livid and oedematous, and the lower part pallid and shrunken, and yet the malformation of the heart was that commonly present in cyanosis. In the *London Medical Times*, March 8, 1845, copied from the *Gazette Médicale*, is the history of a child, six years old, in whom the color was deeper on the right than left side. There had been, however, hemiplegia of this side in infancy, but this had entirely

passed off. On the other hand, in a case of rare malformation communicated by Cooper to Farre, in which the upper part of the system was supplied chiefly by arterial and the lower by venous blood, the discoloration was general. In rare instances livid macule have been observed like those of purpura.

Those affected with cyanosis have generally at birth been well-formed and of the usual size, and in most cases, for a considerable period after birth, the appetite is good, bowels regular, and the system well nourished. But when cyanosis becomes so severe, as it does sooner or later, that its symptoms are rarely absent, digestion is imperfectly performed, and the body becomes either emaciated or stunted and puny. It may be stated, as a rule, that nutrition is in inverse proportion to the gravity of cyanosis. In thirty-three out of forty-one cases, in which the condition of the system, as regards nutrition, was recorded either a short time previously to death or at the autopsy, the body was either considerably emaciated or else diminutive, and those who were well-nourished were usually such as had died early, or of some intercurrent disease.

In this connection may be mentioned two interesting and curious abnormal developments. The chest is often flattened laterally with a projecting sternum, so as to present an appearance generally described in the records as "pigeon breasted." Sometimes the most prominent part is directly over the heart, and in one or two cases the sternum was observed to be deflected towards the left. In the majority of the records, however, no mention is made of the external appearance of the chest.

The other abnormal development is more remarkable, and has not been satisfactorily explained. In twenty-eight cases it is stated that the tips of the fingers or toes, or both, were bulbous. This hypertrophy, if slight, is likely to be overlooked, and that it was observed and recorded in so many cases renders it probable that it was present in a much larger number. In one case the anatomical character of this enlargement was examined, and was found to consist chiefly of hypertrophied cellular tissue. The nails are often incurvated over the deformity. At a meeting of the Lond. Path. Soc. in 1859, Mr. Ogil narrated the history of a laborer, fifty years old, who had swelling, numbness, and lividity of the left arm, from the pressure of an aneurism, and the fingers on this side were clubbed as in cyanosis. A patient whose

history is related in the *Glasgow Medical Journal*, and who was believed to be cyanotic in consequence of a highly emphysematous state of the lungs, had a similar development of the tips of both fingers and toes. Why this bulbous growth should occur in consequence of the circulation of carbonaceous and non-oxygenated blood must at present remain a mystery.

An interesting feature in cyanosis is the low grade of animal heat. The temperature of the body is in all cases below that of health. This is especially noticeable in the extremities. There has not been a sufficient number of accurate thermometric observations to determine whether the internal heat is usually reduced. The following only have been recorded: Mr. Fletcher relates the history of a young man in the *Médecine-Chir. Trans.*, vol. xxv., in whom the thermometer placed in the mouth did not stand above 80° Fahrenheit. Hodgson reports the case of a man, twenty-five years old, in whom the thermometer placed on the tongue, rose to 100°, while in his own case it was two or three degrees below that term. In an experiment, recorded by Nasse, the instrument placed in the mouth, fell little if at all below the healthy standard; applied to external parts, it stood at about 31° Reaumur.

The lack of heat is the source of great discomfort to a cyanotic patient. In mild weather he requires a fire to keep him warm, or an amount of clothing which to others would be intolerable, and in cold weather slight exposure strikes him with a chill. Nor can he increase his heat by active exercise, since his infirmity disqualifies him for this.

Although the temperature of the surface is so low, the occurrence of perspiration, sometimes profuse, is mentioned in several of the records.

In severe cases of cyanosis the generative system is imperfectly developed. In the female, menstruation is scanty or delayed, and in the male the signs of puberty are feebly manifest. If the disease is so mild that the symptoms are absent when the patient is in a state of repose, these organs attain nearly or quite their normal development. The catamenia have appeared as early as the age of sixteen years; and a cyanotic patient treated by Clerrier, had two children, but they both died of scrofulous affections.

The action of the heart is necessarily much affected. In mild forms of the disease, if the patient is quiet, this organ may beat with considerable slowness and regularity, but in all cases exer-

cise or excitement, which in a state of health would scarcely have any appreciable effect on the pulse, embarrasses its movements, and produces palpitation. In severe cases palpitation is rarely absent; the pulse is frequent, feeble, and often intermittent. In a large proportion of cases bruits are produced by the irregular circulation through the heart.

The respiration corresponds with the action of the heart. It is accelerated in proportion to the frequency of the pulse. The suffering in this disease is largely due to paroxysms of palpitation and dyspnea. These occur sometimes without any apparent exciting cause, and when the patient is quiet, but they are commonly induced by those causes which we have already mentioned as aggravating the symptoms of cyanosis. They come on suddenly, and are attended by increase of lividity, distension of the jugulars, and sometimes of the cutaneous veins, and by a sensation of present suffocation. They last only a few minutes, and are succeeded by great depression of the vital powers. In infants, on account of greater nervous irritability, and feeble power of endurance, these paroxysms generally end in convulsions, which occasionally are fatal. A cough is sometimes present, but it is usually slight.

Pain is not a common symptom. Some of the patients complained occasionally of headache, with or without vertigo, and occasionally some of pain in the chest, but it is uncertain to what extent or whether these symptoms were dependent on the cyanotic disease. The excretions do not appear to be affected, so far as has been ascertained. The same may be said of the intellectual and moral faculties. In a case related by Dr. Chevers, the child was even said to be precocious. (*Lowd. Med. Gen.*, vol. xxxviii.) The mind is capable of steady application and acquisition, as in health, provided that the emotions are not unduly excited.

There is said to be a tendency in this disease to hemorrhage, but this liability, if we may judge from recorded cases, appears to be greater in youth and adult life than in infancy. In two cases blood was vomited, in one passed by stool, in one it escaped from the gums, in two from the mouth, in eight from the nostrils, and in sixteen it was expectorated. Pulmonary phthisis was, however, usually present in these last cases. In the *Western Journal of Medicine* for 1829, an interesting case is related by Dr. Wm. M. Voris of a girl, nine years old, in whom hæmorrhage

occurred under the scalp, producing great tumefaction, and nearly closing the eyelids. An incision was made, from which a pint and a half of dark blood escaped, and it was estimated that more than half a gallon was lost during the ensuing two weeks, at the expiration of which time the incision closed. The patient recovered from the hemorrhage but not from the cyanosis.

Towards the close of life there is occasionally more or less anæmia, especially around the ankles, sometimes in the eyelids and face, and rarely to a certain extent over the whole body. In some patients it coexists with effusion in the serous cavities.

It is evident that a person affected with the severer form of cyanosis is disqualified for the duties of active life. The sports of childhood and the useful labors of mature years require an exertion for which he is physically unfit. He has not the ability even to engage in animated conversation, for he is overcome by emotions, whether of joy or sorrow. He lives almost an idle spectator of the world around him, prevented by his indolence from engaging in its scenes.

Intercurrent diseases, especially those of childhood, are badly tolerated; but hooping-cough is the one, which these patients are especially ill fitted to endure. Still, they sometimes pass safely, not only through hooping-cough, but through some of the most dangerous febrile diseases. It is a question of interest, but about which little is known with certainty, whether these intercurrent affections are influenced by the cyanotic or venous condition of the blood. The symptoms of these affections are no doubt more alarming, mainly on account of the embarrassed action of the heart, and not on account of the state of the blood; still it is reasonable to suppose that malignant and asthenic diseases are rendered worse by the lack of oxygen, and excess of the carbonaceous element in the circulating fluid.

Probably cyanosis does not furnish immunity from any other disease, although this statement has been made by a high authority. Rokitansky says: "*All forms of cyanosis, or rather all the diseases of the heart, great vessels and lungs, adapted to produce cyanosis, in a greater or less degree, co-exist with tuberculosis. Cyanosis affords a complete protection against it, and in this circumstance may be found an explanation of the immunity from tuberculosis which many individuals of the system, apparently very different in their character, afford.*" (*Handi, des Pathol. Anst.*, II. Bd.) This state-

ment of the Vienna Pathologist, so authoritatively expressed, is instructive, as showing how erroneous opinions may be formed even by the best observers. So far from its being true, the low degree of vitality in cyanosis does indeed appear to favor tubercular deposition. I have records of twenty-six cases of cyanosis in which tubercles was also present, in several of which the lungs contained cavities. This is about thirteen per cent. of the whole number in my collection—a large proportion, since so many die in early infancy, at which period the tubercular disease is not apt to occur. Cyanosis appears, also, to favor the development of cerebral diseases, especially congestion and coma, as will be seen presently.

PROGNOSIS.—This is unfavorable. Most cyanotic individuals die young. The age which they attain has been made the subject of statistical inquiry by Aberle. He states that in an aggregate of 159 cases, 57, or 35 per cent. died before the end of the first year; 108, or more than two-thirds, died before the age of eleven years; 30 between the ages of 11 and 25 years; and of the remaining 21, five only lived more than 45 years.

The age at which death occurred is given in 126 of the cases collected by myself, as follows:—

In 17 under the age of 1 week.	In 21 from 5 years to 10 years.
" 10 from 1 week to 1 month.	" 41 " 10 " " 20 "
" 15 " 1 month to 3 months.	" 26 " 20 " " 40 "
" 11 " 3 months to 6 months.	" 4 over 40 "
" 17 " 6 " to 12 "	—
" 12 " 1 year to 2 years.	186
" 21 " 2 years to 5 "	

Sixty-seven, then, or more than one-third, died before the close of the first year; 121, or more than three-fifths, before the age of ten years; only 24 survived the age of twenty years, and four the age of forty years. Of course, the duration of life depends on the nature and extent of the malformations. Some of these are such as render a speedy death inevitable.

MODE OF DEATH.—The mode of death is recorded in ninety-five cases, as follows:—

- 19 died in a paroxysm of dyspnoea.
- 10 " suddenly (the exact manner not stated).
- 14 " in convulsions (infants).
- 2 " of apoplexy.
- 7 " from hemorrhage.

6 died of phthisis (though, as we have seen, twenty others had this disease)

2 " of exhaustion, without hemorrhage.

10 " of coma.

2 " of abscesses in the brain.

1 " of each of the following diseases: cerebral irritation, congestion of brain, effusion in the cranial cavity, acute hydrocephalus, paralysis from acute softening of the brain, dysentery, inflammation of heart, syncope, measles in the air-passages, thoracic inflammation, choleraic diarrhoea, pneumonia, bronchitis, scarlet fever, croup. One died in trying to walk, one after a spasmodic cough in pertussis, one after a long agony, one after an agony of ten or eleven hours; one is stated to have died gradually, and three quietly.

The ten who are stated to have died suddenly, probably died in paroxysms of palpitation and dyspnoea, which, we have seen, are easily excited, and of common occurrence in cyanosis. If so, this was the mode of death in 29 cases. Infants, with few exceptions, so far as appears from the records, died in convulsions. Nineteen died of cerebral affections, exclusive of convulsions, and in thirteen of these the cause of death was congestion, apoplexy, or coma. The hemorrhage of which seven died was probably, in most instances, dependent on phthisis, and six are said to have died directly of phthisis. We may, then, regard paroxysms of palpitation and dyspnoea, convulsions, congestive affections of the brain, and phthisis, as common modes or causes of death in cyanosis.

The malformations of the heart and great vessels which give rise to cyanosis are quite numerous. The following table exhibits their character and relative frequency:—

1. Pulmonary artery absent, rudimentary, imperforate, or partially obstructed	97
2. Right auriculo-ventricular orifice imperforate or contracted	2
3. Orifice of the pulmonary artery, and the right auriculo-ventricular aperture imperforate or contracted	6
4. Right ventricle divided into two cavities by a supernumerary septum	11
5. One auricle and one ventricle	12
6. Two auricles and one ventricle	4
7. A single auriculo-ventricular opening; inter-auricular and inter-ventricular septa incomplete	1
8. Mitral orifice closed or contracted	2

	CASES.
9. Aorta absent, rudimentary, imperious, or partially obstructed	2
10. Aortic and the left auriculo-ventricular orifices imperious or obstructed	1
11. Aorta and pulmonary artery transposed	14
12. The eara entering the left auricle	1
13. Pulmonary veins opening into the right auricle or into the cave or septo veins	2
14. Aorta imperious or contracted above its point of union with the ductus arteriosus; pulmonary artery wholly or in part supplying blood to the descending aorta through the ductus arteriosus	2
Total	244

From the above table it appears that in more than one-half of the cases of cyanosis, the congenital vice which gives rise to it is located in the pulmonary artery. It is located also, in general, in that part of the artery which is nearest the heart. Its character is different in different cases. Sometimes there is an arrested development of this vessel, and in its place we find simply a ligamentous cord extending from the heart as far as the ductus arteriosus, while beyond, the pulmonary artery and its branches are pervious; rarely the entire artery is ligamentous and, of course, imperious; in other cases this vessel is open through its whole extent, but the part nearest the heart is so small as to be properly considered rudimentary; in others still, there is adhesion of the valves to each other as the chief congenital defect, and, finally, in rare instances, the obstruction in the pulmonary artery is due to an adventitious membrane, which stretches across the vessel like a diaphragm. These last malformations, namely, adhesion of the valve and the formation of an adventitious membrane are, doubtless, due to inflammation occurring in the artery before birth, and some attribute the arrested development and ligamentous state of the vessel to the same cause.

In most cases of cyanosis due to obstructive malformations there is deficiency in the inter-auricular and inter-ventricular septa. This deficiency obviously results from the obstruction, for the septa are formed in the heart, after focal circulation is established, and the blood being prevented by the vicious formation from flowing in in its proper channel, necessarily passes to the opposite side of the heart. More or less blood being forced from one auricle or one ventricle to the opposite cavity, it is evident that a permanent aperture must result in the septum. The aper-

ture in the septum ventriculorum is ordinarily at its base; in the septum auriculorum, it corresponds with the foramen ovale.

In most of the obstructive malformations one and rarely two abnormal cardiac murmurs have been observed. The single murmur accompanies the ventricular contraction. As it has been observed in cases of complete, as well as incomplete obstruction, it seems to be due mainly to the flow of blood through the apertures in the septa.

MODES OF COMPENSATION.—In most cases of cyanosis, the congenital defect is partially obliterated by modes of compensation. Is the most frequent malformation, that in which there is obstruction in the pulmonary artery, and a considerable part if not all the blood flows directly from the right to the left side of the heart, the ductus arteriosus not only remains open, but is greatly enlarged, through which a current of blood enters the pulmonary artery from the aorta, and passing to the lungs is oxygenated. The bronchial arteries have also been found greatly enlarged, and it is believed that though they are the nutrient arteries of the lungs, the blood which they convey to those organs is decarbonized in its circuit through them. In a case published by Mr. Le Gross Clark, in the *Medico-Chir. Trans.*, vol. xxx., the bronchial arteries were not only enlarged, but a "branch from the internal mammary artery, which accompanied the parietic nerve, was nearly equal in size to the parent trunk, and expended itself principally in the adjacent adherent lung." Branches of the intercostal arteries have also been found enlarged, and entering the lungs, or connecting with vessels which entered the lungs. By such modes of compensation cyanosis is rendered milder, and life is prolonged. To these we must attribute the fact that some have very considerable malformation, and yet do not become cyanotic.

MORBID ANATOMY.—This, as regards the circulatory system, has been sufficiently dwelt upon. No chemical analysis, so far as I am aware, has yet been made of cyanotic blood. We know that it is dark, its coagulability feeble, that it contains an excess of carbonic acid, and is deficient in oxygen. From the nature of cyanosis, it would be inferred that in many cases there is a degree of passive congestion in the cavities of the heart, and consequently in the capillaries of the systemic system, giving rise to more or less serous effusion. Statistics show that this is so. The quantity of pericardial fluid is in some patients increased. I have

records relating to this fluid in fifty-one cases. Usually it was pure serum. In seventeen the quantity was half an ounce or less, if we include in the number those in which the amount is expressed in such terms as "due quantity," "usual amount," and "small amount." In twenty-four cases the serum exceeded half an ounce: usually estimated at from one to six ounces, but in two it exceeded the latter quantity. In one of the twenty-four the serum was sanguinolent. In two cases the records state that there was a small quantity of blood in the pericardium, and in the remaining patient the two pericardial surfaces were agglutinated by fibrinous exudation.

In some of the autopsies serous effusion was found in the pleural cavities, usually in connection with pericardial effusion, and in at least one instance the serum was tinged with blood. Old adhesions between the costal and pulmonary pleura were observed in a few instances. The condition of the lungs was recorded with more or less minuteness in one hundred and ten cases. Mention has already been made of the large number affected with tubercular disease, which was either confined to the lungs, or was chiefly exhibited in these organs. In thirty-five patients the records state that the lungs were of small size, either by compression, or sometimes, apparently, by the continuance of the foetal state over a greater or less portion of the organ. The compression was produced either by the distended pericardium or by effusion in the pleural cavities. In thirty-five cases the lungs presented a dark color. This hue in some specimens accompanied the unexpanded or foetal state of the organ, but in others there was the normal inflation, and the dark color was due to engorgement or congestion. In other cases the lungs are stated to have been natural, except the color. In nine there was emphysema in a part of the lungs: in two pneumonia; in two the color was pale, in one a bright crimson; in one the lungs were larger than natural, in one the right lung was absent, and in seventeen these organs were recorded healthy.

I have records of the state of the liver in twenty-six cases, in sixteen of which it was enlarged, and in four of the sixteen it was congested. Congestion was present in eight other cases, in which no mention is made of the volume. The parenchyma had a natural appearance in nine cases, but in some of these there was enlargement. From these statistics it is probable that the liver is

commonly enlarged in cyanosis, and not infrequently congested. In a few cases the condition of the other abdominal viscera is mentioned, in some as healthy, in others as congested. There were fifteen examinations of the brain, in seven of which congestion is recorded, and in three abscesses in the cerebral substance, in one of which cases the lateral ventricle was also filled with pus; in two there was softening of a portion of the brain, in three the brain was firm or compact, in three the quantity of fluid in the cranial cavity exceeded the normal amount, and in one it was less.

THEORIES RELATING TO THE ETIOLOGY OF CYANOSIS.—Although in nearly all cyanotic patients there are direct communications between the two sides of the heart, it is shown by many observations that these communications or apertures are not sufficient in themselves to produce cyanosis. This opinion was expressed half a century ago by Louis, who published an excellent monograph on the subject of these communications, basing his remarks on an analysis of twenty cases. Since the publication of his paper the belief has been pretty general in the profession, and observations continue to substantiate it, that although the apertures may be of considerable size, if the two sides of the heart, with their orifices and vessels, are in their normal state so that they act symmetrically and without obstruction, cyanosis will not occur. In proof of the correctness of this opinion many cases might be cited of a previous, and some of a largely dilated foramen ovale without the cyanotic hue, cases which have been published in the journals since the appearance of Louis's monograph. Still in cases of obstructive malformation, unless the obstruction is complete, cyanosis is more apt to occur in consequence of these apertures, for were they absent a larger amount of blood would be propelled through the narrowed orifice, and a larger amount consequently be oxygenated.

Allusion has already been made to the two theories which prevail in the profession; the one attributing cyanosis to the intermingling of venous and arterial blood; the other to obstruction at the centre of circulation, and consequent venous congestion. There are serious objections to the acceptance of either theory as an explanation for all cases. That admixture of the two kinds of blood is not essential to the production of cyanosis, is apparent from the following facts. In one case in the *Fourth Malforma-*

tion, there was no communication between the two sides of the heart, and the ductus arteriosus was closed, so that admixture was impossible. Again, in the *Eleventh Malformation*, or that in which the aorta and pulmonary artery are transposed, the blue disease evidently does not depend on the admixture of the two currents. On the other hand, in this curious state of the heart, the more the admixture the less the cyanosis, since the only way in which the systemic current of blood can be arterialized is by passing to the opposite side of the heart. An argument against this doctrine may also be found in the fact that the modes of compensation are not such as in any way diminish or obviate the admixture. It is admitted that in the more frequent malformations cyanosis is increased by the apertures, which allow the intermingling of the venous and arterial currents, but it is more reasonable to consider the intermingling and the cyanosis as the direct results of the malformation, neither having the precedence of the other, than to consider that they are related to each other as cause and effect, or as proximate and remote results. Viewed in this light, the admixture must be considered simply a concomitant of the cyanosis.

The second theory, that of venous congestion, has numbered among its advocates many who have given special attention to the subject, as Morgagni, Louis, and Stillé, but it seems to have even less claim for acceptance than the theory of admixture. It has been seen that in nearly all cases of cyanosis the two sides of the heart communicate freely, so that if the current of blood meets with an obstruction, as it commonly does, it readily escapes to the opposite side where the artery is large and gives it free passage. In this way congestion, if not prevented, is greatly diminished. Again, it will be seen that, although certain of the viscera are frequently found at the autopsy more or less congested, congestion is not uniformly present in the organs, as it would be were it the proximate cause in all cases of cyanosis.

Moreover, in some patients the malformation is not obstructive. The cavities and their orifices are of the normal size, and cyanosis is due entirely to malposition of the vessels. It cannot be said that in these cases there is venous congestion from arrest at the centre of circulation. If there is any congestion it must be due to the fact that venous blood does not circulate as readily as the arterial in the capillaries. It is true that in the paroxysms of

dyspnoea there is sometimes more or less congestion; the distension of the jugulars shows this, but it subsides with the paroxysms, and is probably no more than usually occurs when the respiration is greatly embarrassed.

In fine, attempts to express the immediate pathological state producing cyanosis in the terms of a general law have failed. However plausible the above theories may appear in regard to certain cases, there are others to which they are manifestly inapplicable. Those who advocate these theories seem to lose sight of the obvious fact, that the chief want of the economy in cyanosis is arterIALIZATION of the blood, and it is hardly supposable that there can be any correct theory of its causation which is not founded on this fact. With this want of the economy *in vivo* it does not seem difficult to express a theory in comprehensive terms which is applicable to all cases, such as the following: *Cyanosis is due to some defect in the organism, usually congenital, which prevents the free and regular flow of blood to, through, or from the lungs.* So comprehensive a statement includes not only cases of malformation and malposition of the heart and its vessels, but also those few cases in which the lungs are in fault. In most patients, as we have seen, the current of blood *to* the lungs is obstructed, and the current of blood *from* the lungs, in those comparatively rare cases in which the malformation is on the left side.

TREATMENT.—From the nature of cyanosis, it is evident that the treatment should be more hygienic than medicinal. The patient should be warmly clad and kept in a warm room, and all agencies calculated to embarrass or disturb the functions of the body or excite the emotions, and thereby accelerate the action of the heart, should be studiously avoided. The diet should be nutritious, but simple and easily digested.

Those who have attributed cyanosis wholly to apertures in the inter-auricular and inter-ventricular septa, and the consequent flow of blood from the right to the left side of the heart, have considered it an important part of the treatment to keep the patient reclining on the right side, so as to diminish this flow by the effect of gravitation. The reader, however, must be convinced from the nature of the malformations that little benefit can accrue from following such advice. Still patients are sometimes less cyanotic and more comfortable in one position than

another. In a case reported by Mr. Howship (*Edin. Med. Journ.*, 1818) "the only easy and indeed comfortable position in which the child could remain was that usual in nursing. When erect, the dusky color of the face and neck became a dark blue." In a case related by Mr. Spackman (*Lond. Med. Gaz.*, 1833), the patient was raised on the hands and knees. Louis reports a case (*Obs. Le Common, des. Cas, etc.*) in which the selected position was with the head elevated; Wm. Hunter a case (*Med. Obs. and Ess.*, vol. vi.), in which the patient avoided paroxysms by lying on the left side. Struthers and King each report a case, in which the patients seemed most comfortable while lying on the right side (*Monthly Journ. of Med. Sci.*), while, on the other hand, Prof. White of Buffalo (*Dist. Med. Journ.*, 1855), and Dr. Jas. Carson (*Amer. Journ. of Med. Sci.*, 1857), report cases in which position on the right side failed to produce any alleviation of symptoms. Other similar observations might be cited, but enough have been mentioned to show that no one position should be recommended for cyanotic patients. Some obtain most relief by lying on the back, others on the right side, others on the left, some when on the hands and knees, some when reclining on either side indifferently, while, finally, others suffer most when erect.

There was a time when the paroxysms were treated by venesection, but depletion has long since been abandoned. Physicians now rely on stimulants, antispasmodics, friction to the chest, and mustard pediluvia to relieve the urgent symptoms, although this treatment is but partially successful.



APPENDIX.

A.

THE modes of preparing milk for infants, which are described in the chapters relating to feeding, are simple, and are therefore preferable to more difficult processes. If the milk thus prepared disagree, other formulae may be employed which furnish a product more closely resembling human milk. The two following, which are extracted from Routh's *Treatise on Infant Feeding*, are among the best. In both the amount of cream is diminished and of sugar increased. First, Prof. Falkland's method:—

"One-third of a pint of pure milk is allowed to stand until the cream has risen. The latter is removed, and to the blue milk thus obtained, about a square inch of rennet is to be added, and the milk vessel placed in warm water. In about five minutes the curd will have separated, and the rennet, which may again be repeatedly used, being removed, the whey is carefully poured off, and immediately heated to boiling, to prevent its becoming sour. A further quantity of curd separates, and must be removed by straining through calico. In one-quarter of a pint of this hot whey is to be dissolved three-eighths of an ounce of milk sugar; and this solution along with the cream removed from the one-third of a pint of milk, must be added to half a pint of new milk. This will constitute the food for an infant of from five to eight months old for twelve hours; or, more correctly speaking, it will be one-half of the quantity required for twenty-four hours. It is absolutely necessary that a fresh quantity should be prepared every twelve hours; and it is scarcely necessary to add that the strictest cleanliness in all the vessels used is indispensable."

The second method is that by Mr. Lobb:—

"Half a pint of new milk is set aside for the cream to separate, which latter is removed; and to the blue milk half a teaspoonful of prepared rennet is added; this is placed over the fire and heated until the curd has separated, when it is broken up with a spoon, and the whey poured off. In winter, three drachms of powdered sugar

of milk are added to this warm whey; and the whole is mixed with half a pint of new milk. In summer, three drachms and a half of sugar of milk are added, and with the new milk are all boiled together.*

I have had no experience in the use of milk prepared by either of these two methods. An objection to the latter process is the boiling, which is believed to impair the quality of milk.

The above formulae are designed especially for infants who have not reached the age at which it is proper to give farinaceous food. They may also be employed for older infants who are in a state of feebleness, and whose digestive organs are capable of assimilating only the blandest preparations of food.

Meigs, in his treatise on diseases of children (page 267), recommends an article of diet which he states agrees better with the digestive system of the infant than any other kind of food which he has employed. The mode of preparation and the proportions are as follows: "A scruple of gelatine (or a piece two inches square of the flat cake in which it is sold) is soaked for a short time in cold water, and then boiled in half a pint of water, until it dissolves, about ten or fifteen minutes. To this is added, with constant stirring, and just at the termination of the boiling, the milk and arrowroot, the latter being previously mixed into a paste with a little cold water. After the addition of the milk and arrowroot, and just before the removal from the fire, the cream is poured in, and a moderate quantity of loaf sugar added. The proportions of milk, cream, and arrowroot must depend on the age and digestive powers of the child. For a healthy infant, within the month, I usually direct from three to four ounces of milk, half an ounce to an ounce of cream, and a teaspoonful of arrowroot, to half a pint of water. For older children the quantity of milk and cream should be gradually increased to a half or two-thirds milk, and from one to two ounces of cream. I seldom increase the quantity of gelatine or arrowroot."

Baron Liebig has also recommended a soup for infants which he believes to be the best substitute for human milk. By the mode of preparation starch is transformed into sugar and dextrin, a change which, when farinaceous substances are used in the usual way, is effected in the stomach, and thus this organ is relieved from a part of the burden of digestion.

*The following is the best way of preparing this food: Half an ounce of wheaten flour, and an equal quantity of malt flour, seven grains and a quarter of bicarbonate of potash, and one ounce of water are to be well mixed; five ounces of cow's milk are then to be added, and the whole put on a gentle fire. When the mixture begins to

thicken it is removed from the fire; stirred during five minutes; heated and stirred again, till it becomes quite fluid, and finally made to boil. After the separation of the lumps by a sieve, it is ready for use. By boiling it for a few minutes, it loses all taste of the flour."—(*Gazette*, January 7th, 1865; *Brookman's Bazaar*, July, 1865.)

Liebig has succeeded in preparing an article the ingredients of which, and their relative proportion, are very similar to those of human milk. It has, however, twice the consistence of milk, or, as Liebig expresses it, is "the double concentration" of that secretion.

Dr. Hassell, in a communication in reference to this food, to the *London Lancet* for July 29th, 1865, says: "It appears to me that the great merit of Liebig's preparation consists in the use of malt flour as a constituent of the food; this, from the diastase contained in it, exercises, when the fluid food or soup is properly prepared, a most remarkable influence upon the starch, quickly transforming it into dextrin and sugar, so that in the course of a few minutes the food, from being thick and sagacious, becomes comparatively thin and sweet."

"Correct and ingenious as are the principles upon which this food has been designed, yet the directions given for its preparation are certainly open to considerable improvement. Thus, Liebig directs that the malt should be ground in a common coffee mill, and the coarse powder passed through a sieve. This necessitates the subsequent straining of the food, a tedious operation, in order to remove the bran and remaining particles of husk. And further, that the food should be put upon a gentle fire previous to its being finally boiled. Now, a gentle heat may mean almost any temperature nearly up to the boiling point; and since the action of the diastase is destroyed at about 150° F., the temperature ought never be allowed to exceed that degree.

"I recommend, therefore, that the malt should be well freed from husk, and finely ground; that the wheat flour should be lightly baked; and finally, that a thermometer should be employed in the preparation of the food. Indeed, in some samples recently submitted to me by Messrs. Savory & Moore, I find that the first two points have been attended to, and that they use malt freed from husk and finely ground, and the wheat flour baked.

"The effect of baking the wheat flour is to partially cook the starch, entering into its composition, so that less heat is required in the preparation of the liquid food. I find that a temperature ranging between 140° and 145° is amply sufficient to effect the complete transformation, and solution of the starch acquires, and, indeed, to cook the food sufficiently."

I have, in some cases, directed food to be given prepared as recommended by Dr. Meigs, but my observations in reference to the effect of it have not been sufficient to enable me to speak confidently in regard to it. Gelatine is of little value as a nutritive substance, but it is the opinion of some that, when combined with farinaceous substances, it renders them less irritating.

Lélig's soup was prepared a few times for the foundlings in the Infant's Service in Charity Hospital. The result did not justify the expectations which had been formed in consequence of the plausibility of the theory, and the reputation of the great chemist. On the first day in which it was used, an unusually large number of the foundlings were observed to vomit. The soup was prepared under the supervision of the matron of the institution. The test was not conclusive, as it is probable that there was some fault in the preparation, or in the materials used. The mode of preparing this soup is too tedious for common use, but it deserves trial in cases in which the ordinary kinds of food disagree.

I have collected the above formula on account of the great importance of the use of properly-prepared and digestible food in the regimen of infants, especially those that present symptoms of indigestion. Success in the treatment of diarrhoeal affections, and of all infantile diseases which are attended by feebleness of the digestive functions, depends as much on dietetic as therapeutic measures. The physician should, therefore, be as familiar with dietetic as he is with medicinal formulae, that he may use them as occasions arise.

The egg bears considerable resemblance to milk and to flesh, in its chemical composition, and it is often relished by infants and children. It is useful in states of feebleness, on account of its highly nutritive properties; and, if given nearly raw, it is easily digested. It should not be heated above 130° Fahr., for a higher temperature coagulates the albumen. It may be prepared by being placed in boiling water for two minutes. This will warm it sufficiently, while only a little of the exterior of the albumen is coagulated.

It remains to speak of meat and the meat-broths. Raw meat was first employed by Professor Welose, of St. Petersburg, in the treatment of infantile diarrhoea, consequent on weaning. The lean of beef or mutton should be used, and the finely-divided portions removed by scraping, given to an infant from eight to twelve months old in quantity varying from one to two teaspoonsful, three or four times in twenty-four hours. A larger amount may be given, if the infant wishes it. Raw meat prepared in this manner, or very finely cut, is not only very nutritious, but it sometimes agrees better with the digestive organs of the infant, than any of the preparations of milk.

The use of the pulp of raw meat was introduced into the Children's Wards of Philadelphia Hospital in 1856, by Dr. Caspar Lewis. It was seasoned with salt, and sometimes sugar was added, to render it more palatable. A teaspoonful was at first allowed three or four times daily, and the quantity was gradually increased. Infants who were suffering from malnutrition, were found to thrive with the use of this food as a part of their daily diet. The pulp of raw meat has been most frequently employed in private, as well as hospital practice, in the treatment of the indigestion and diarrhoea of infants. Many infants reduced to a state of scollencness and emaciation, gradually recover flesh and strength with the use of this diet, which is more easily digested; while it is more nutritious than firmaceous substances, or cow's milk. The only danger in the use of raw meat is that of producing trichinosis. With care, however, in selecting the meat, danger from this source is slight, as trichinosis is a comparatively rare disease. Professor G. T. Elliott, of Bellevue Hospital Medical College, highly recommends, in his lectures, the use of raw meat for infants wasted with chronic diseases, and whose digestive organs are enfeebled.

Beef-tea, prepared in the ordinary manner, by adding finely-divided meat to three or four times its bulk of cold water, allowing it to macerate half an hour, and then boiling it fifteen or twenty minutes, is much used for its highly nutritive properties in infantile diseases, as well as a food for healthy infants. Given, however, in diarrhoeal affections of infants, I have often observed that it produced a laxative effect, so that it was necessary to discontinue its use. The same effect, though in less degree, sometimes occurs from the use of mutton or chicken-tea, in similar cases. Beef-essence prepared from finely-chopped beef, placed dry in a loosely-corked bottle, and standing three or four hours in boiling water, is a highly nutritive substance. It is the juice of the meat containing all those principles which heat can extract. It is often useful, given in small quantities, in exhausting diseases, especially in those in which the stomach is irritated, and more bulky food is rejected. Evidently, the albumen of the meat is coagulated by the heat, and, therefore, lost.

LIEBIG'S BEEF-TEA is too expensive for common use, but it is a more nutritious and better preparation than the beef-essence. It is prepared as follows: Finely-divided beef is lixiviated with cold water, so as to remove from it all soluble substances. The solution is evaporated to dryness over a sand bath, at a temperature of about 120°. At so low a temperature neither the albumen nor the coloring matter is coagulated. The tea, which contains, unchanged, nearly

all the nutritive principles of beef, together with the salts, may be diluted with water at the time of its use.

Beef-tea which has been subjected to the action of gastric juice has also been recommended. The mucous membrane of the stomach of some animal is macerated in water, to which a little hydrochloric acid is added in the proportion of three drops of the strong acid to one ounce of water. The maceration, which should be at a temperature of about 78° Fahr., produces a liquid having the solvent properties of gastric juice. Beef-tea is prepared according to Lislé's formula, and then diluted with cold water. This solution should remain a few hours cold, and then the artificial gastric juice be added. The fibrin and albuminous substances are digested. The product which results has been called artificial rhyme. In cases of deficient gastric juice, or feeble digestive power of the stomach, it is obvious that this food may possess decided advantages.

Dr. Roith speaks of Hogarth's Essence of Meat, which is little known in this country (*Infant Feeding*, page 204). "Of the composition," says he, "of this material I can say nothing, except that I believe it is a concentrated solution of meat tea—in fact, a meat tea reduced by the evaporation of its watery ingredients to the consistence of a syrup. I can, however, confidently speak from experience of its utility. It is certain that children who have been reduced to a state of great weakness by hand-feeding, or improper diet, occasionally recover, and that almost miraculously, under its influence. I have used principally the essence of beef. Its taste is much liked; and in doses of five or six teaspoonfuls daily, with a very little water, it is well digested by children. Indeed, it is often borne in infants affected with exuberant diarrhoea from weaning, when milk and farinaceous food disagree."

Meat teas, and essences which require so much care and time in their preparation as those of Liebig and Hogarth, are obviously to be employed only in those cases in which there is disease or derangement of the digestive organs, or feebleness of the digestive function, so that the ordinary kinds of food disagree. Most infants in good health are able to digest at the age of twelve or fifteen months, when the period of weaning arrives, those kinds of solid food which are easily digested, if well prepared and mashed or cut fine.

As regards the use of farinaceous food for infants and young children, barley flour properly boiled in milk or water is as easily digested and as nutritious as rice, or wheat flour, or arrowroot, and in some instances it appears to agree better. I now generally recommend it in preference to these substances.

An article of food employed in this city for the diarrhoea of infants

is prepared as follows: A pound of dry wheat flour, of the best quality, is packed snugly in a bag and baked three or four hours. When it is taken from the bag it is hard, resembling a piece of chalk, with the exception of the exterior, which is wet, and should be removed. The flour grated from the mass should be used the same as arrowroot or rice.

APPENDIX B.

The following observations relate to the state of the liver in that form of infantile enterocolitis which prevails in the summer months, especially in the cities. They were made in order to determine the correctness or falsity of a pretty general belief on the part of city practitioners, arising probably from the frequent green appearance of the stools, that the function of the liver is perverted, and the bile therefore unhealthy in this disease. These observations are sufficiently numerous, in my opinion, to prove that mercurial or other treatment designed to modify or correct the function of this organ is not justified by the anatomical characters of the disease.

June 8, 1859. Aged 5 months; duration of sickness, 5 days. Liver appeared healthy; about the usual size.

June 8, 1859. Aged 5 months; duration of sickness, 20 days. Liver of usual size and color; it contained the usual amount of oil globules; from one to six or eight globules in each hepatic cell.

June 10, 1859. Aged 4 months; duration of sickness, 5 days. Liver of ordinary appearance; contains rather less fatty matter than usual; few hepatic cells contained more than five or six oil globules.

July 4, 1859. Aged 7 months; duration of sickness, 3 weeks. Liver of yellowish hue; smaller than natural; not enlarged; the oil globules considerably exceeded the usual amount.

July 16, 1859. Aged 9 weeks; duration of sickness, 2 weeks. Liver small and almost destitute of oil globules; nine-tenths of the hepatic cells contained none.

August 8, 1859. Aged 7 months; duration of sickness, 1 month. Liver appeared healthy; weighed on iv.

August 15, 1859. Aged 19 months; duration of sickness, several weeks. Liver extended half an inch below the margin of the ribs; weighed on ix; but few oil globules in most of the hepatic cells; a few contained numerous small globules.

August 15th, 1859. Aged 15 months; duration of sickness, 2 months. Liver of usual appearance; weight on vijs; nothing unusual observed in this organ under the microscope.

August 15, 1859. Aged 14 months; duration of sickness, 3 weeks. Liver weighed on ix; its appearance natural both to the naked eye, and under the microscope.

August 17, 1859. Aged 15 months; duration of sickness, several weeks. Liver appeared healthy; weight, on vi.

August 22, 1855. Liver of normal appearance; it contained the usual amount of oil globules; weight, oz. viij.

August 27, 1855. Aged 9 months. Liver of natural color generally, but yellow in places; weight, oz. viij; no more than the usual amount of fatty matter discovered by the microscope.

August 31, 1855. Aged 6 months; duration of sickness at least one month. Surface of liver mottled of a yellow color; no excess of oil globules generally; weight of liver, oz. viii.

September 4, 1855. Aged 2 months; duration of sickness, one week. Liver of normal appearance; few hepatic cells contained more than four oil globules, and many contained none; little free oily matter.

September 6, 1855. Aged 16 months. Liver small; weighing oz. vi and containing very little oily matter.

September 15, 1855. Aged 23 months; duration of sickness, all summer. Liver quite fatty; weighing oz. xv; had tuberculosis.

July 3, 1860. Aged 13 months; duration of sickness, nearly one month. Liver of yellow color; weight oz. vi; hepatic cells contained somewhat more than the usual oily matter.

July 4, 1860. Aged 4 weeks. Liver extended two inches below the ribs; weight oz. v; contained few oil globules.

August 4, 1860. Duration of sickness, two weeks. Liver weighed oz. ii; mottled yellow; very fatty.

August 17, 1860. Aged 2 months; duration of sickness, 10 days. Anterior border of liver even with the margin of the ribs; weight oz. iiij; usual color; very few oil globules, free or in the hepatic cells.

August 8, 1860. Aged 2 years. Liver mottled with yellow, evidently fatty spots or patches.

August 17, 1860. Liver extended half an inch below the lower margin of the ribs; of usual color; weight oz. v.

August 20, 1860. Aged 6 months; duration of sickness, one week. Liver extended half an inch below the margin of the ribs; rather yellow; weight oz. ix; numerous oil globules, both free and in the hepatic cells.

July 16, 1861. Liver about the usual size and appearance, except that the color is lighter in some places than in others.

August 1, 1861. Aged 2 months; duration of sickness, about one week. Liver small and very dark; the microscope showed it to be almost destitute of oily matter.

August 12, 1861. Aged 3½ months. Anterior margin of liver even with the ribs; weight oz. viii.

August 15, 1861. Aged 14 months. Weight of liver, oz. xiii; contained the normal amount of fat.

August 24, 1861. Aged a few months. Liver of usual appearance; weight, oz. iiij.

October 9, 1861. Aged 28 months; duration of sickness, all summer. Liver rather yellow, but not uniformly; weight, oz. ix; some hepatic cells free from fat; others loaded with it.

July 7, 1862. Aged 4 months; duration of sickness, several weeks. Weight of liver, oz. v; yellow, very fatty.

August 27, 1862. Aged 7 months; duration of sickness, several weeks. Liver examined by the microscope seemed healthy; weight, oz. viij.

August 23, 1862. Aged 10 months; duration of sickness, 1 week. Weight of liver, oz. viij; appeared healthy, except an increase in the amount of oil globules.

APPENDIX C.

INTUSSUSCEPTION IN SMALL INTESTINE.

No. 1. Aged 12 years. Had pain in abdomen two or three weeks previously. Died the fifth day. Twelve inches of the upper part of the jejunum invaginated in the next twelve inches below. (M. R. Trevor, Amer. Jour. Med. Sci., Jan., 1852.)

No. 2. Aged 3 years. Previous health not stated. Died the second day. At about the junction of the jejunum and ileum, twenty-six inches of intestine had been received into six inches. (Lear: Thomas, M. D., Amer. Med. Recorder, 1825.)

No. 3. Aged 4½ months. Previous health good. Died the fourteenth day. Jejunum of ileum: upper part of ileum: the mass was two-thirds of an inch long. (Dr. J. L. Smith, Amer. Med. Times, July 18, 1853.)

No. 4. Aged 6 months. Had enterocolitis previously to, and during the intussusception. Four invaginations in the jejunum, each from one to one and a half inches in extent. (Records of N. Y. Infant Asylum, July 18, 1862.)

INTUSSUSCEPTION OF ILEUM INTO COLON.

No. 5. Age not stated. Had previously constipation, followed by diarrhea and convulsions. Died on the fifth day. Two inches of the ileum projected into the cecum. (Dr. Martin, Path. Soc. Dublin, March 18, 1828.)

No. 6. Aged 2 years. Previously well. Died the second day. About three inches of the ileum invaginated had passed through the ileo-cæcal valve into the colon. (Dr. Cargwell, Lond. Lanc., July, 1855.)

No. 7. Aged 4 years. Previously well except slight diarrhea. Died the ninth day. Thirteen inches of the ileum had passed through the ileo-cæcal valve into the cecum. (Mr. Filster, Lond. Lanc., May, 1855.)

No. 8. Aged 3 years. Previous health not given. Died after seven days. At least a foot of the ileum had passed through the ileo-cæcal valve. (Mr. Summell, Path. Soc. London, March 26, 1860.)

No. 9. Aged 4 months. Previous health good. Died after six weeks. The ileum, still adherent, had passed through the entire colon, so as to protrude six inches beyond the anus. (S. Jones, Lond. Path. Soc., 1857.)

No. 10. Aged 6 months. Previously well. Died the third day. The ileum had passed through the cecum and into the ascending colon. (Dr. Cutting, Boston Soc. for Med. Improvement, July, 1852.)

No. 11. Aged 4 years and 3 months. Had a cough, and stated the age of eighteen months, thread worms, was unwell by these the day before the sickness. Died the fifth day. Seven inches of the ileum had passed through the ileo-cæcal valve. (Dr. Hare, Lond. Path. Soc., October 16, 1848.)

INVAGINATION OF THE CÆCUM-ILEUM AND CÆCUM, OR ILEUM, CÆCUM, AND COLON.

No. 12. Aged 3 months. Previous health good. Died the fifth day. Six inches of the ileum and the ascending colon were invaginated in the sigmoid flexure and rectum. (Thomas Blizard, Med.-Chir. Trans., vol. 1.)

No. 13. Aged 4 months. Previous health good. Lived more than one week. A small portion of the ileum and the entire colon in the sigmoid flexure, were invaginated in the latter. (Alfred Markwick, Lond. Lanc., 1846.)

No. 14. Aged 1 year. Diarrhea previously. Died on the seventh day. A portion of the ileum with the cecum invaginated in the ascending and transverse colon. (Dr. O'Ferrill, Lond. Med. Times, January 16, 1847.)

No. 15. Aged 4 months. Previous health good. Died the third day. Several inches of the ileum, the caecum, the ascending and the transverse colon, were lodged in the remainder of the transverse and in the descending colon. (Wm. Parker, Lond. Lanc., August 18, 1863.)

No. 16. Aged 4 months. Previous health good. Died the third day. Lower part of the ileum, the caecum, ascending colon, and greater part of the transverse were imbedded in the descending portions. (G. Y. Smith, Lond. Lanc., June 21, 1863.)

No. 17. Aged 4 months. Sick two days previously. Died the third day. Cecum and ascending colon invaginated in the transverse and descending colon. (P. P. Nich, Lond. Lanc., June 27, 1863.)

No. 18. Aged 20 months. Previous health not stated. Died on the fourth day. Six or seven inches of the lower portion of the ileum, the caecum, and the ascending colon, were filled with coagulated intestine; the six or seven inches of the ileum were drawn together so as to measure only one inch, and this part of the ileum had formed a second invagination in the caecum to the extent of two inches. (Mr. Taylor, Lond. Lanc., 1862.)

No. 19. Aged 4 years. Previous health not stated. Lived 4 days. Lower part of the ileum and the entire colon were invaginated in the caecum. (W. S. Purkin, Brit. Med. and Surg. Journ., May 2, 1866.)

No. 20. Aged 5 months. Previous health not stated. About one inch of the ileum and the entire colon to the left hypochondrium were lodged in the remaining portion of the colon and in the caecum. (R. Harlan, M. D., F. R. S., Med. and Phys. Researches.)

No. 21. Aged 6 years. Diarrhoea and pain in abdomen. The sigmoid coli and the first half of the colon had descended through the other half and the caecum; the lower part of the ileum was drawn down through the centre of the invagination to the anus. (Mr. Harris, Med. Repos., December, 1824.)

No. 22. Aged 9 months. Had occasional diarrhoea. Died the third day. A considerable portion of the ileum and the sigmoid coli had been forced up the ascending colon, across the transverse and down to the rectum. (H. Cline, Glasgow, Lond. Med. Gaz., September 15, 1856.)

No. 23. Aged 5 months. Previous health not given. Died the fourth day. Lower portion of the ileum, the ascending colon, and a part of the transverse colon were invaginated in the remaining portion of the colon and the caecum. (Alex. Murray, Path. Anat. of the Alms-House, &c.)

No. 24. Aged 4 months. Previous health good. Died the third day. Cecum and ascending colon were lodged in the transverse and beginning of the descending portions; in the interior of the mass was a second invagination, that of the ileum. (Dr. Ryan, Med. Soc. of Lond., October 27, 1855.)

No. 25. Aged 4 months. Previous health good. Died the second day. Part of the ileum and caecum and a considerable portion of the colon were invaginated. (Eugene Kennedy, Dub. Journ. of Med. Sci., March 1, 1844.)

No. 26. Aged 7 months. Previous health good. Died the third day. Part of the ileum and the caecum had descended through the colon and rectum to within half an inch of the anus. (Dr. Buchanan, Lond. Path. Soc., May 3, 1855.)

No. 27. Aged 6 months. Previous health good. Died the fifth day. A part of the ileum and the whole upper portion of the large intestine were lodged in the descending colon and the caecum, to within two inches of the anus. (Mr. Ballard, Lond. Path. Soc., January 6, 1857.)

No. 28. Aged 3 months. Previous health good. Died the third day. Part of the ileum and the ascending and transverse colon were lodged in the descending colon. (J. W. Ferri, Lancet, March 28, 1853.)

No. 29. Aged 2 months. Previous health not stated. Died the first day. A large part of the ileum, the ascending and transverse colon were invaginated in the descending portion. (M. Jackson, Gaz. Med., December, 1852.)

No. 30. Aged 3½ years. Almost constant pain in the bowels for three months before death. The caecum and entire colon, to within eleven inches of

the anus, were invaginated in the remainder of the colon, and in the rectum. The intussusceptum protruded five or six inches beyond the anus. (M. Gouin, *Mém. de l'Acad. Roy. de Chirurgie*, 1754.)

No. 31. Aged 4 years. Had dysentery previously. Died after sickness of nearly a month. The ascending and transverse colons were found in the sigmoid flexure and rectum; the ileum extended uninterruptedly through the whole mass. (John C. Lottison, M. D., P. R. S.)

No. 32. Aged 3 months. Previous health delicate, but without disease. Died the second day. Six inches of the ileum, the ascending and transverse colon lay within the descending colon and the rectum. (Mr. Young, *Brit. Med. Jour.*, September 24, 1859.)

No. 33. Aged 11½ months. Previous health not stated. Died the third day. About four inches of the ileum, the ascending and transverse colon, were invaginated in the descending colon. (Mr. Clarke, *Lond. Lanc.*, February 17, 1855.)

No. 34. Aged 6 months. Previous health not stated. Died the eighth day. The cecum, ascending and transverse portions of the colon were invaginated in the descending colon. (R. Smith, *Lond. Path. Soc.*, December 4, 1848.)

No. 35. Aged 4 months. Previous health good. Died in convulsions. Lower portion of the ileum invaginated in the ascending colon, which was then invaginated in the arch. (Mr. Gorham, *Guy's Hosp. Reports*, October, 1862.)

No. 36. Aged 2 months and 4 days. Previous health good. Died on the eighth day. Twelve inches of the ileum coiled on itself, had descended the whole length of the colon, as it is protruded from the anus; colon drawn together, the mass occupying but three feet. (Dr. J. L. Smith, N. Y., *Path. Soc.*, June, 1861.)

No. 37. Aged 2 years and 4 months. During two years before death complained of pain in abdomen. The cecum was inverted, and had descended in the lower portion of the rectum. (Walter Worthington, M. D., *Amer. Journ. of Med. Sci.*, January, 1845.)

No. 38. Aged 10 months. Previous health good, except liability to constipation. Lived two days. A double intussusception in the inferior portion of the ascending colon was invaginated in the superior, and the whole mass invaginated in the transverse colon. (Dr. Wilson, *Proc. Med. and Surg. Assoc.*, May 3, 1848.)

No. 39. Aged 11 years. Previous health not stated. Recovered. On the fifth day, the caecal coli and a portion of first colon, with the mesocolon, measuring thirteen and three-fourth inches, were gained from the bowels. (J. W. Bowman, *Edin. Med. and Surg. Journ.*, October, 1812.)

No. 40. Aged 6 years. Previous health not stated. Recovered. On the eleventh day voided the coccyx and a part of the colon. (J. H. King, *Lond. Lanc.*, 1834.)

No. 41. Aged 4 months. Previous health good. Died the third day. The cecum had descended through the colon, nearly to the rectum. (Dr. Penzance, *L'Union Médicale*, Aug. 22, 1845.)

No. 42. Aged 5 years. Was ill with fever and pain in region of bladder for four months; date of commencement of intussusception not known. Recovered. Passed by stool eight inches of the ileum, the cecum, and four inches of the colon. (Dr. Quain, *Lond. Path. Soc.*, Aug. 16, 1858.)

No. 43. Age not stated. Previous health good. Died the third day. The upper part of the descending colon had descended into the inferior part to the extent of two inches. (Dr. Montgomery, *Lond. Med. Times*, December 23, 1849.)

No. 44. Aged 6 months. Slight diarrhea two or three days previously to sickness. Intussusception in the transverse colon to the extent of two or three inches. (R. Y. Steele, *Lond. Lanc.*, June 23, 1862.)

No. 45. Aged 4 months. Had nausea with vomiting for three weeks previously to severe symptoms. Died after six days. The lower portion of the colon and the upper part of the rectum, had descended into the portion below. (Mr. Henshaw, *Edin. Med. Journ.*, April, 1857.)

UNCERTAIN.

No. 46. Aged 4 months. Had disordered bowels from birth. Died on the sixth day. An intussusception was found in the left iliac region. (H. F. Carter, *Lond. Lanc.*, June 7, 1848.)

No. 47. Aged 6 years. Previous health not stated. Recovered. Twenty-three inches of intussus were discharged. (Leri Gayford, *Amer. Journ. of Med. Sci.*, October, 1827.)

No. 48. Aged 22 years. Previous health not stated. Recovered. Fifteen or eighteen inches of ileum were passed by stool. (F. Bask, *Lond. Med. and Phys. Journ.*, December 18, 1822.)

No. 49. Aged 12 years. Had occasional purging and pain in the rectum. Recovered. A portion of ileum twelve inches long was passed. (John Lang, *Lond. Lanc.*, October, 1855.)

No. 50. Fatal. An invagination of the intestine was found in the rectum (Dr. Jacobi, *N. Y. Path. Soc.*, August 5, 1865.)

No. 51. Aged 8 years. Had dysentery previously. Recovered. A portion of intestine measuring ten inches was passed. (Dr. Plummer, *Medico-Chirurgical Soc., Edin.*)

No. 52. Aged 8 months. Previous health good. Died the second day. A portion of intestine protruded. (E. Y. Steele, *Lond. Lanc.*, June 25, 1846.)

INDEX.

A ABSCESS, retro-pharyngeal, 319
 age, 319
 cause, 319
 anatomical characters, 320
 symptoms, 321
 diagnosis, 324
 prognosis, 324
 treatment, 325

ABSCESSES IN Jaws, 328
 ACUTE SCARLET, 323
 ACUTE, 323
 ACUTE, hydrocephalus, in pertussis, 342
 AFFLUENT, cold, in scarlet fever, 402
 ALUMINUM, a report of scarlet fever, 482
 ALLEN, Dr., on retro-pharyngeal abscess, 319
 ALTRIS discharges in disease, 75
 in cutaneous inflammation, 364
 ANAEMIA, bronchitis, in pertussis, 343
 ANAEMIA in tetanus musculorum, 191
 ANAEMIA, 323
 ANIMAL HEART, 72
 APPENDIX, 691
 ARTIFICIAL FEEDING, 58
 ASACID VOMITING, 469
 ATROPHY in pertussis, 341
 ATROPHY OF Lungs, 80
 ATTITUDE in disease, 84

BARRIER, M., on follicular stomatitis, 399
 case of intestinal worms, 398
 BEAUF, M., case of hemorrhage, 316
 BEETLES for infants, 402
 BIEBER, 694
 BELLADONNA for prevention of scarlet fever, 302
 in pertussis, 341
 BILLARD, M., case of tetanus musculorum, 191
 cases of gangrene of mouth, 398
 on gelatinous infusing, 385
 on non-inflammatory diarrhoea, 390
 BOUTET, M., on meningitis, 325
 microscopic character of exudation in meningitis, 328
 epistaxis in meningitis, 344
 cases of ophthalmia, 355

BOUTET, M., on prominent contractions from ophthalmia, 355
 dilation of lung in pneumonia, 355
 dysentery in infancy, 355
 treatment of intestinal hemorrhage, 417
 BOWDITCH, Dr., roots of Homocentesis, 352
 BRAIN, development of, 76
 chemical analysis of, 76
 growth of, 76
 shape of, 77
 ingestion of, 94
 BRUCH, M., on location of fluid in congenital hydrocephalus, 312
 BROUWER on diphtheria, 462
 BRUSH, 325
 capillary, 357
 chronic, 345
 causes, 356
 anatomical characters, 336
 symptoms, 340
 diagnosis, 344
 prognosis, 344
 treatment, 345
 BROMIDE of potassium in ophthalmia, 357
 BROMIDES in pertussis, 343
 BROMIDE solution in croup, 346
 BROWN-SQUARED on compression of sympathetic nerve in ophthalmia, 354
 belladonna in pertussis, 341

CANCRUM ORIBI, 397
 CATHOLIC acid in croup, 300
 CARRUT, Dr., on softening of stomach, 344
 CASE of mother in pregnancy, 39
 Castor-oil plant as a galactagogue, 48
 Catarrhs, effect on the milk, 40, 51
 Cerebro-spinal system, disease of, 71
 Chemical analysis of brain, 76
 Cholepneum, 409
 CHICKEN-POX, 328
 CHILDHOOD, its characteristics, 18
 Cholera infection, 388
 causes, 388
 symptoms, 388
 anatomical characters, 381
 diagnosis, 392
 prognosis, 394

- Cholera infantum**—
treatment, 366
- Charley, Dr. A. R.**, case of convulsions from dentition, 269
- Circulatory system**, 66
Diseases of, 678
- Clarke, Dr. Joseph**, treatment of trichinæ ascarides, 375
- Clark, Prof. A.**, case of syphilis in a child, 525
- Cochran, J. S.**, peritonitis, 344
- Colley, Dr.**, case of intestinal convulsions, 365
- Colic of childhood**, 354
causes, 354
symptoms, 355
diagnosis, 363
prognosis, 366
treatment, 367
- Colic of lungs in bronchitis**, 379
- Colles, Dr.**, on typhus enterica, 376
- Colostrum**, 34
- Composition of milk**, 34
- Composition of urine**, 94
causes, 94-95
symptoms, 97
anatomical characters, 97
prognosis, 99
treatment, 99
- Composition of stomach**, 325
- Conan, Dr. H. P.**, inflammation as a precursor of scarlet fever, 346
on vaccine virus, 328
on syphilis of infants, 666
- Constrictions, perianal, from schyphæ**, 379
- Convulsions, intestinal**, 392
causes, 394
anatomical characters, 395
symptoms, 395
diagnosis, 399
prognosis, 399
modes of death, 399
treatment, 399
close, or Schyphæ.
- Course of lactation**, 65
- Cow's milk, composition**, 68
for infants, 59
- Coryza**, 393
causes, 393
anatomical characters, 394
symptoms, 394
prognosis, 395
treatment, 395
- Croup, spasmodic**, 316
primary membranous, 317
complication of measles, 366
- Crawford, M.**, on cerebral spasm, 365
on gelatinous swelling, 342
- Cry, the, in disease**, 64
- Cummings, Dr. W. B.**, on the amount of milk secreted, 42
- Cystitis**, 379
Herskovitz of, 379
see also, 382
causes of the inflammation, 382
time of commencement, 384
symptoms, 386
prognosis, 384
mode of death, 382
modes of compression, 384
morbidity, 384
injuries relating to the etiology, 384
treatment, 386
- DALTON, Prof. J. C.**, on fetal deformities, 22
- Dentition**, 356
order of dental evolution, 356
physiological results of, 360
diagnosis, 310
treatment, 351
second dentition, 353
- Diseases of infantile diseases**, 61
- Diphtheria, non-inflammation**, 347
causes, 348
symptoms, 349
anatomical characters, 350
diagnosis, 351
prognosis, 351
treatment, 352
inflammatory, 355
- Diet, effect on milk**, 37
- Digestive system**, 71
diseases of, 283
- Digestion, post-mortem**, 341
- Dilatation of bronchial tubes in bronchitis**, 349
- Diseases of cerebro-spinal system**, 74
- Diphtheria**, 423
anatomical characters, 423
symptoms, 425
causes, 426
sequels, 427
prognosis, 428
diagnosis, 426
treatment, 426
- Diphtheritic paralysis**, 423
its treatment, 423
- Dr. Bond**, on determining the capability for weaning, 39
necessity for early weaning, 41
on richness of milk, 39
- Dysentery in infants**, 355
in children, 384
- Dyspepsia**, 327
- ECLAMPSIA**, 154
causes, 154
premonitory symptoms, 155
symptoms, 157
prognosis, 157

- Edemata**—
 peritæ, 528
 anatomical characters, 100
 diagnosis, 161
 prognosis, 162
 treatment, 162
- Eczema**, 571
 symptoms, 572
 diagnosis, 575
 treatment, 571
- Eggs of food**, 584
- Electricity**, use of, in promoting secretion of milk, 86
- Ellis, Prof. Geo. T.**, case of retro-pharyngeal abscess, 320
 detection of retro-pharyngeal abscess, 324
 use of raw meat, 359
- Empyema**, 373
- Emetia in endo-cervitis**, 381
- Enteritis of chick-kind**, 384
 symptoms, 385
 diagnosis, 385
 prognosis, 386
 treatment, 386
- Enterocolitis of infancy**, 355
- Erysipelas**, 569
 age, 562
 point of commencement, 563
 causes, 563
 precursory symptoms, 567
 symptoms, 567
 prognosis, 568
 duration, 568
 modes of death, 569
 pathological anatomy, 568
 treatment, 571
- Erythema**, 556
 ages, 556
 latencies, 556
 nodules, 557
 diagnosis, 557
 prognosis, 557
 treatment, 557
- Etter in epidemic laryngitis**, 215
- Evans and Marshall**, on treatment of gangrene of mouth, 561
- FACTS** in reference to lactation, 21
 Falkland's, Prof., mode of preparing milk, 600
- Features in disease**, 62
- Fever subacute, in ewes**, 220
- Feeding, artificial**, 52
- Fiet, Prof. Antis, Sr.**, on thoracocentesis, 241
 treatment of varicose eruption, 154
- Fiet, Prof. Antis, Jr.**, on the diet of children, 51
- Fleming, Mr.**, on retro-pharyngeal abscess, 320
- Folow, Dr.**, cases of erysipelas, 556
- Froelich, Dr.**, on state of thyroid gland in lateral curvatures, 154
- GALATHEQUES**, 40
- G**
 Galloway, 301
 gangrene of mouth, 567
 anatomical characters, 267
 age, 268
 causes, 268
 symptoms, 269
 diagnosis, 269
 prognosis, 269
 treatment, 269
- Gao, identified**, 72
- Gastritis**, 335
 causes, 336
 age, 337
 symptoms, 338
 anatomical characters, 338
 duration, 339
 prognosis, 339
 treatment, 339
- Gastritis**, 340
- Gastritis**, 341
- Geddes, Dr.**, on treatment of gangrene of mouth, 563
- Gibb, Dr.**, case of edema in calf, 64
- Gibb, Dr.**, on the use of various composites, 89
- Glands, intestinal**, state of in enterocolitis, 356
- Gray, Dr. David**, cases of leucorrhœa, 426
- Green, M.**, on prognosis in laryngitis, 141
 on laryngitis, 202
 cause of epiglottic laryngitis, 215
 pseudo-membranous laryngitis, 219
- HALL, MARSHALL**, on epiglottic hydropneumia, 149
- Hall, Prof.**, case of anasarca lactation, 46
 treatment of lateral curvatures, 202
- Hammill, Wm. A., Prof.**, on leucorrhœa of external os, &c., 21
- Hassell's, Dr.**, remarks on Listig's food, 601
- Hawley, James S.**, use of popoia, 524
- Head, appearance in disease**, 52
- Heat, animal**, 21
- Helms, James**, on leucorrhœa in, 172
- Holmes's method for vesicles**, 317
- Hemorrhage, internal**, 91
 causes, 99
 anatomical characters, 160
 morbid, 341
 cerebral, 344

- Hæmorrhage, cerebral—
 symptoms, 104
 capillary, 105
 diagnosis, 109
 prognosis, 110
 treatment, 110
 gastro-intestinal, 412
 three forms, 412
 prognosis, 416
 treatment, 416
 Hæmorrhoid, *q. v.*, on state of thyreoid gland in
 internal coarctation, 136
 Hæmorrhoid's, common of anal, 100
 Hooping-cough, 642
 Hydrocephalus, spurious, 147
 anatomical characters, 147
 symptoms, 149
 diagnosis, 152
 prognosis, 152
 congenital, 111
 anatomical characters, 112
 symptoms, 116
 diagnosis, 118
 prognosis, 119
 treatment, 119
 acquired, 120
 causes, 120
 anatomical characters, 122
 symptoms, 122
 prognosis, 122
 treatment, 122
 Hypertrophy of brain, 82
 anatomy of, 82
 causes of, 84
 symptoms of, 84
 diagnosis of, 86
 prognosis, 87
 treatment, 87
 Hyperplasia of intestinal glands, 207

I

- IMPERFECT of the new-born, 62
 Imperfect brain, 75
 causes of, 79
 symptoms, 80
 prognosis, 80
 Inflammation of bowels, 255
 chronic, 255
 Infancy, its characteristics, 18
 Insufflation of ink in pneumonia, 250
 Intercerebral hæmorrhage, 99
 Internal coarctation, 192
 Indigestion, 327
 causes, 328
 symptoms, 329
 prognosis, 331
 treatment, 331
 Iodine in treatment of intussusception,
 875
 Intestinal inflammation of infancy, 355
 causes, 357
 age, 361

Intestinal inflammation of infancy—

- symptoms, 362
 anatomical characters, 366
 treatment, 374
 regional anastomosis, 374
 medical treatment, 376
 external treatment, 383
 Intussusception, 418
 diaply, 418
 with symptoms, 419
 previous health, 419
 causes, 420
 age, 421
 sex, 422
 pathological anatomy, 422
 in small intestines, 423
 in large intestines, 425
 symptoms, 425
 diagnosis, 431
 duration, 432
 mode of death, 434
 treatment, 434
 cases of, 469

JACOB, Prof. A., on internal coarctation, 136

- on tracheotomy in croup, 231
 Jackson, Dr. James, on chest liss, 215
 on cholera infantum, 375
 Jenner, Edward, performance of vaccination, 547
 Jery, Benjamin, performance of vaccination, 547

KERNES mineral, as a cause of gastritis, 336

- Kitch, Dr., trachea nascent in, 172
 Knechtel, Dr. Ernst, tracheotomy in croup, 241

LACTATION, 28

- hindrances to, 28
 failure in reference to, 31
 course of, 35
 Lactometer, 52
 Lactoscope, 55
 Laryngitis, simple, 297
 symptoms, 297
 chronic, 298
 anatomical characters, 299
 treatment, 309
 Spasmodic, 210
 causes, 211
 symptoms, 211
 anatomical characters, 212
 pathology, 212
 diagnosis, 213
 prognosis, 214
 treatment, 214

Laryngitis—

- pseudo-membranous, 217
- causes, 217
- anatomical characters, 218
- symptoms, 220
- pathological character, 222
- diagnosis, 225
- prognosis, 225
- treatment, 224
- Loewig, Dr. James R., cases of croup-
lary, 225
- Lovy, Dr., cases of tetanus anaxetous,
177
- Libig's food for infants, 552
- feeding, 555
- Umbil. appearance of, in disease, 62
- Liver, statistics of, in catarrho-colic, 359
- 567
- Littigstine's, Dr., cases of uterine lac-
tation, 44
- Livington, E. H., treatment of squamous
laryngitis, 255
- Loth's, Mr., mode of preparing milk, 551
- Lombard and Planchard, Drs., case of
uterine hemorrhage, 195
- Lombroso, 395

MEASLES, 169

- symptoms, 169
- complications, 168
- nature, 168
- diagnosis, 168
- prognosis, 169
- treatment, 169
- Mead, row, use for food, 555
- Melny, Dr. J. P., case of eclampsia in
scarlet fever, 165
- use of about the neck, 229
- use of wormwood for intestinal worms,
 557
- food for infants, 561
- treatment of intestinal convulsions, 201
- Melena, 412
- Meningitis, simple and tubercular, 122
- anatomical characters, 125
- causes, 122
- prodromal stage, 123
- symptoms, 124
- diagnosis, 129
- prognosis, 146
- treatment, 142
- Menstruation, effect on milk, 46
- Merrill, Prof. A. P., on chloroform in
eclampsia, 167
- Microcephalus, 89
- Milk, human, 55
- changes of it from diet, 57
- its retention in the breast, 59
- by age, 58
- by various impurities, 59
- by fermentation, 49

Milk, changes of—

- by pregnancy, 49
- promptly required, 42
- difference in quantity and quality, 41
- anatomy, its treatment, 45
- mode of examining, 53
- vitronous in, 51
- of the cow, 55
- and of the goat, 49
- mode of preparing, 60
- Mortality of early life, 23
- its causes, 24
- Morbilli, 466
- Morbus cerebri, 578
- Mother in pregnancy, 19
- exercise, 19
- dresses, 19
- emotions, 20, 21
- Movements in disease, 54
- Muguet, 291
- Mumps, 545

NAVEL, inflammation of, 359

- its use in tetanic maculations, 176
- Nervous influenza, 279
- Nephritis after scarlet fever, 483
- Naves, Prof. H. B., on the use of the
ophthalmoscope, 75

OESOPHAGITIS, 325

- causes in foodstuffs, 325
- treatment, 327
- Oedema albuginis, 292
- Ophthalmoscopy in disease, 75
- Oxyuris tenaculata, 491
- Ovum, M., on diagnosis of eclampsia,
 161

PARKEE, WILLARD, case of petro-
pharyngeal abscess, 225

- Parke, E. H., on cholera infantum, 556
- treatment of, 235
- Parotiditis, 545
- symptoms, 546
- nature, 546
- diagnosis, 547
- treatment, 547
- Pertussis, 331
- symptoms, 342
- first period, 331
- second period, 332
- third period, 333
- complications, 344
- convulsions, 354
- bronchitis, 355
- pneumonia, 355
- emphysema, 357
- diagnosis, 357
- prognosis, 358

Pertussis—

- treatment, 509
- Pfeiffer, Paul, treatment of croup, 225
- Poppy in digestion, 318
- Pharyngitis, simple, 314
 - anatomical characters, 313
 - causes, 316
 - symptoms, 316
 - prognosis, 316
 - diagnosis, 317
 - treatment, 317

Pleuritis, 268

- causes, 268
- anatomical characters, 272
- symptoms, 274
- physical signs, 275
- diagnosis, 277
- prognosis, 278
- treatment, 279
- hydrothorax, 281

Pneumonia, 289

- lobar and lobular, 291
- types, 291
- anatomical characters, 294
- symptoms, 295
- physical signs, 291
- diagnosis, 297
- prognosis, 298
- treatment, 298

Pneumonia, 292

- Pott, Prof. Alfred, virus-pharyngeal abscess, 324
- Pouch, abscess of, in young, 220
- Purgative, effect on the skin, 41
- Pseudo-membranous laryngitis, 212
- Palatine leaflets, 98
 - in disease, 76

QUANTITY of milk received by the infant, 32

Quack-silver in laryngoscopy, 400

RAW meat for food, 165

- Respiratory system, 55
 - in health, 55
- Respiration in disease, 67
- Reynolds, Dr. J. N., case of dysphasia, 153
- Rhinal carcinoma polypiformis, 18
- Rhinit and Rhinitis or appearance of hypertrophied tonsils, 87
 - in rhinorrhea, 88
 - cases of cerebral aneurysm, 185
 - in lateral rhinorrhea, 185
 - in pharynx, 208
- Rhinitis or hypertrophied tonsils, 83
- Roth, Dr., mortality from change of temperature, 28
 - on use of cancer-oil plant, 48
- Rhinitis or hypertrophy of tonsils, 82

Rheuma, 518

- latitudo, 528
- meteo, 528
- antennalis, 528
- symptoms, 529
- causality, 529
- diagnosis, 529
- causes, 529
- prognosis, 529
- treatment, 529

Rheuma, 529

SANTONIN as an antispasmodic, 190

- Sarcitis, 575
 - diagnosis, 576
 - treatment, 576
- Sarlet fever, 471
 - character, 472
 - symptoms, 472
 - regular form, 472
 - irregular form, 473
 - malignant form, 477
 - complications, 478
 - prognosis, 482
 - epidemic, 482
 - etiology, 482
 - anatomical characters, 482
 - tissue, 480
 - diagnosis, 481
 - prognosis, 481
 - treatment, 482
 - infection, 485
 - prevention, 485

Scarcity of milk, 14

- treatment of, 45
- Schiller, M., cases of interstitial hemorrhage, 162
- Sigbee, Dr., effect of maternal inspiration, 32
- Solution of acetanilide, 14
- Sore, Dr., on belated vaccination, 581
- Sore, disease of, 581
- Sore, Dr., mode of applying electricity to the human, 47
- Solka, Prof. Stephen, case of congenital hydrocephalus, 157
- Solka, Dr. Tyler, on the use of the electric plant, 48
- Solomon, white, 141
 - galactosis, 141
- Solka of phthisis, 162
- Solka, Matthias, 168
- Sore, 291
- Solution of liver in endocarditis, 307
- Solka, 481 C. in 1891, 227
- Solka, Morton, on phthisis, 163
- Solka, composition of, 305
- Sore, Dr. Tyler, 298
 - anatomical characters, 298
 - causes, 297
 - symptoms, 298

Stomach, follicular—

diagnosis, 281

progress, 281

treatment, 281

single, 281

causes, 281

symptoms, 281

significance, 281

treatment, 281

stomach, 281

causes, 281

symptoms, 281

progress, 281

treatment, 281

Stomach, 281**Sulphur for scabies, 477****Symptoms in syphilitic diseases, 456****Swart, Prof., on identification, 551**

case of leucorrhoea, 414

Syphilis, treatment of, 414**Syphilis in testis, 42****Syphilis, 417**

anatomy, 417

diagnosis, 417

prognosis, 417

clinical history, 417

causes, 417

various patches, 417

various, 417

petechiae, 417

skin, 417

disorders, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

various, 417

TESTA, 401**Tapeworm, 401****Variola of arming and potius as a cause of gangrene, 456****Vergil, M., on treatment of gangrene of mouth, 462****Temperature in measles, 401**

in scarlet fever, 417

Tetanus antivenereum, 168

period of incubation, 171

frequency, 171

causes, 171

symptoms, 171

mode of death, 171

progress, 171

duration in fatal cases, 171

in fatal cases, 171

diagnosis, 171

preventive treatment, 171

preventive treatment, 171

preventive treatment, 171

preventive treatment, 171

Tetanus—

incubation, 168

Thrombosis in cranial sinuses, 48

anatomical characters, 48, 49

causes, 48

symptoms, 48

diagnosis, 48

progress, 48

treatment, 48

Thrush, 291

anatomical characters, 291

symptoms, 291

causes, 291

diagnosis, 291

progress, 291

treatment, 291

Thymus gland in internal cancer, 164**Thymus gland in internal cancer, 164****Thymus, M., case of tetanoid human**

stage, 168

case of tetanoid human, 168

Trachoma in eye, 431**Trichomycosis of hair, 491****Treatment, on the pulse, 67**

in internal cancer, 164

treatment of spasmodic laryngitis,

217

treatment in measles, 471

treatment of scarlet fever, 458

treatment of pertussis, 446

Trunk, appendages in disease, 42**Umbilical, inflammation of, 466**

state of, in tetanus antivenereum, 171

Urticaria, its use in measles, 471**VACCINIA, 166**

history of vaccination, 167

symptoms, 167

anatomy of, 167

symptoms of, 167

sequela, 167

subsequent vaccinations, 167

protective power of variola, 167

revaccination, 167

Vallée, M., case of inter-cranial haemorrhage, 164, 165

on August, 164

his death from diphtheria, 431

Vallée, 164

incubative period, 164

stage of invasion, 164

of reaction, 164

of desiccation, 164

Variola, 414

mode of death, 414

anatomical characters, 414

complications, 414

progress, 414

diagnosis, 414

diagnosis, 414

diagnosis, 414

diagnosis, 414

diagnosis, 414

diagnosis, 414

- Varioloid—
 treatment, 515
 Variola, 525
 symptoms, 525
 diagnosis, 526
 prognosis, 526
 Varicella, M., case of cerebral apoplexy, 535
 Virulentus brand in milk, 51
 Virchow on thrombosis, 59
 Virus vaccine, selection of, 517
 Volvulus, 518
 Vomiting a symptom, 12
 Von, Dr. Lohr, on tracheotomy in croup, 241

WADE, Dr., on the albuminuria of diphtheria, 548
 Ware, Dr., on pseudo-membranous laryngitis, 219
 Watson, Dr. Thos., remissions in meningitis, 142
 Wauing, Dr.
 West, Dr., case of thrombosis, 55
 cases of lateral contractions, 194
 on meningitis, 132
 on resolution in meningitis, 142
 on treatment of gangrene of rectum, 334
 West India, tetanus intervention in, 122
 Westmore, selection of, 51
 proper age, 51
 low health, 52
 syphilis in, 52
 colicium in the milk of, 52
 Whitt, Dr., on meningitis, 122
 Whym, historical, 228
 species of, 228
 causes, 232
 symptoms, 232
 diagnosis, 233
 prognosis, 233
 treatment, 237

ZINC, article of, in croup, 524
 Zymotic diseases, 413

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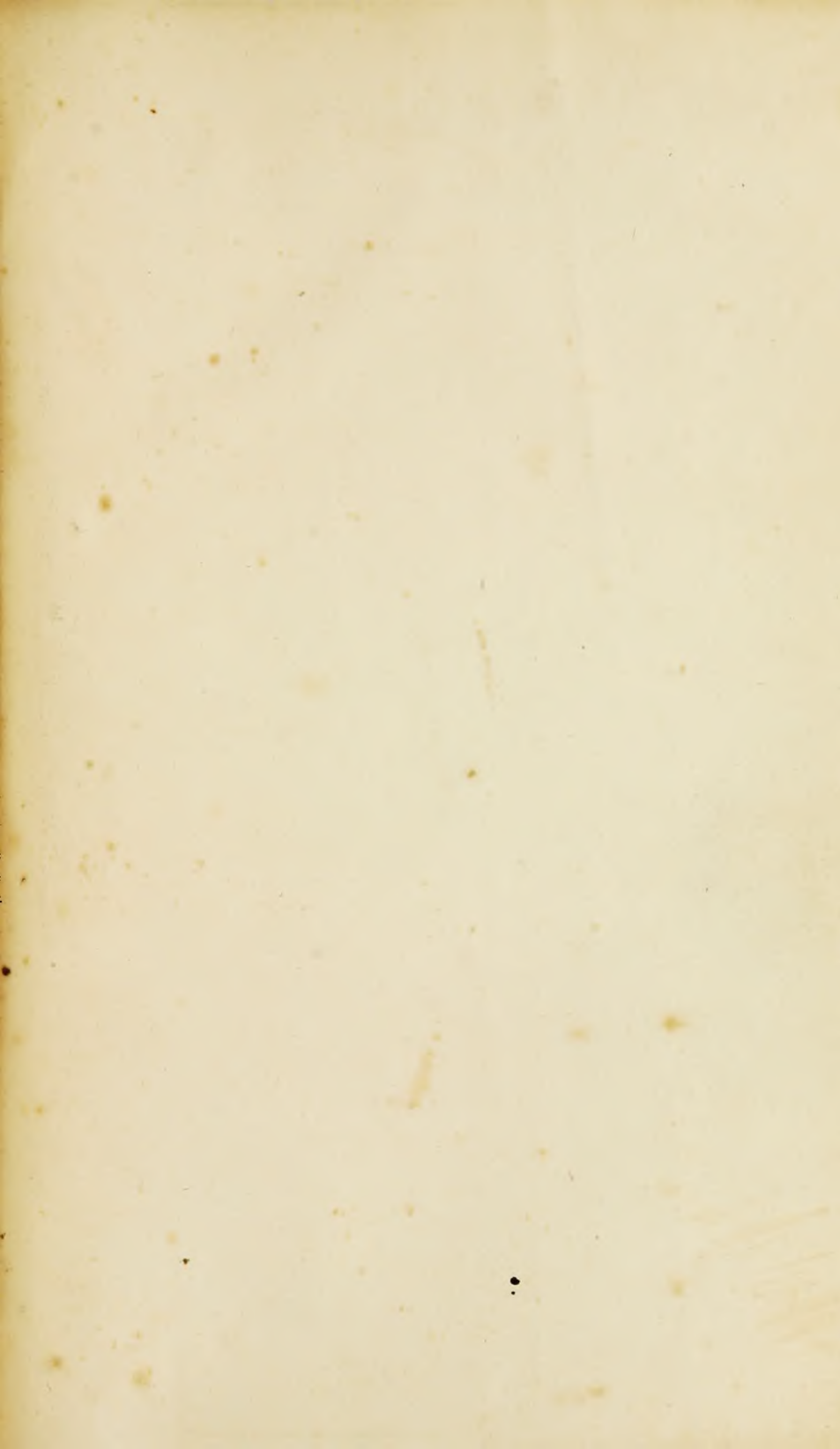
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INDEX TO CATALOGUE.

	Page		Page
Allen's Diseases and Physical Treatment	1	Lea's Superstition and Faith	11
American Journal of the Medical Sciences	2	Lea's Treatise on Cancer Surgery	11
Almon, Half-Century of the Med. Sciences	3	Leishman and Wilson on Syphilis	12
Anatomical Atlas, by Smith and Morton	4	Le Sueur on Pelvic Fever	14
Anatomy of the Nervous and Senses	5	Le Sueur on Puerperal Fever	14
Arnold's Chemistry	11	Le Sueur and Brown's Obstetric Surgery	15
Arnold on Diseases of Females	12	Le Sueur on the Eye	15
Arnold on Small Diseases	13	Le Sueur on Medical Observations	15
Arnold on the Nervous	14	Le Sueur's Physiological Chemistry, 2 vols	16
Arnold on the Eye	15	Le Sueur's Chemical Physiology	16
Arnold's Medical Diagnosis	16	Le Sueur's System of Examination	16
Arnold's Practice of Medicine	17	Le Sueur on Fever	17
Arnold's (John E.) Practical Chemistry	18	Le Sueur's Surgical Anatomy	17
Arnold's (John E.) Medical Chemistry	19	Le Sueur's Operative Surgery, by Brown	18
Arnold & Taylor's Chemistry	20	Le Sueur's Physiology	18
Arnold's Clinical Lectures on Surgery	21	Le Sueur's Dispensary and Formulary	19
Arnold on the Surgical Diseases of Women	22	Le Sueur on Diseases of the Eye	19
Arnold on Venereal	23	Le Sueur's Notes and Library	20
Arnold and Telford's Anatomy	24	Le Sueur's (John E.) The Science and the Art	21
Arnold on Venereal	25	Le Sueur's Lectures on Diseases of Women	21
Arnold and Collier's Atlas of Venereal	26	Le Sueur on Puerperal Fever	22
Arnold's Human Physiology	27	Le Sueur's System of Obstetrics	22
Arnold's Comparative Physiology	28	Le Sueur's Practice of Surgery	23
Arnold on the Use and Abuse of Alcohol	29	Le Sueur's Principles of Surgery	23
Arnold's Synopsis of Medical Medicine	30	Le Sueur on Puerperal	24
Arnold on the Indigestion	31	Le Sueur on Urinary Organs	24
Arnold and Smith's Dispensary	32	Le Sueur on Diseases	25
Arnold's System of Medicine	33	Le Sueur and Smith's Compendium of Med. Science	25
Arnold on Diseases of Females	34	Le Sueur's Atlas of Diseases of the Skin	26
Arnold on Diseases of Females	35	Le Sueur on Diseases of the Skin	26
Arnold on Puerperal Fever	36	Le Sueur's Practical Chemistry	27
Arnold on Venereal	37	Le Sueur on Digestion	27
Arnold on Diseases of Children	38	Le Sueur on Conception	28
Arnold's (J. E.) Lectures on Surgery	39	Le Sueur's Practical Pharmacy	28
Arnold's Atlas of Venereal Diseases	40	Le Sueur's System of Surgery	29
Arnold on Diseases of the Teeth	41	Le Sueur's Med. Notes and Treatises, 2 vols	30
Arnold's Practical Medicine	42	Le Sueur and Brown's Anatomy, by Le Sueur	31
Arnold's Human Physiology	43	Le Sueur's Anatomy	32
Arnold on Gout-Liver etc.	44	Le Sueur on Urinary Diseases	33
Arnold's System of Midwifery	45	Le Sueur on Parturition	34
Arnold's Diseases of Females	46	Le Sueur on Puerperal Fever	35
Arnold on Diseases of Children	47	Le Sueur's Midwifery	36
Arnold's Practice of Medicine	48	Le Sueur's Physiological Anatomy	37
Arnold's Medical Dictionary	49	Le Sueur's Medical Notes and Treatises	38
Arnold's Human Physiology	50	Le Sueur's Anatomy	39
Arnold on New Diseases	51	Le Sueur's Operative Surgery	40
Arnold's Medical Dictionary, by Smith	52	Le Sueur's System of Surgery	41
Arnold's Practice of Medicine	53	Le Sueur and Smith's Anatomy, by Le Sueur	42
Arnold on Venereal Diseases	54	Le Sueur's General Pathology	43
Arnold on Urinary Organs	55	Le Sueur on Females	44
Arnold on the Skin	56	Le Sueur's Operative Surgery	45
Arnold's Practice of Medicine	57	Le Sueur on Parturition	46
Arnold's Urinary Chemistry	58	Le Sueur's Midwifery	47
Arnold on the Lung, &c.	59	Le Sueur (H. H.) and Brown's Anatomical Atlas	48
Arnold's Surgery	60	Le Sueur (H. H.) on Conception	49
Arnold's Pathological Physiology, by Le Sueur	61	Le Sueur on Venereal Diseases of Children	50
Arnold's Diseases of Chemistry	62	Le Sueur on Anatomy and Diseases of the Skull	51
Arnold's Anatomy	63	Le Sueur's Therapeutics	52
Arnold's (H. H.) Universal Formulary	64	Le Sueur's Journal of Clinical Medicine	53
Arnold on Urinary Organs	65	Le Sueur on Puerperal	54
Arnold on Venereal Diseases in the Female	66	Le Sueur's Medical Therapeutics	55
Arnold's Principles and Practice of Surgery	67	Le Sueur on Diseases of Females	56
Arnold's Pathological Anatomy	68	Le Sueur on Urinary Organs	57
Arnold's Synopsis of Medicine	69	Le Sueur on Venereal	58
Arnold's Compendium of the Medical Sciences	70	Le Sueur and Brown's Physiological Anatomy	59
Arnold's Anatomy and Physiology	71	Le Sueur on the Skin	60
Arnold on Allimentary Canal	72	Le Sueur on the Skin	61
Arnold on Rheumatism and Gout	73	Le Sueur on Surgical Operations	62
Arnold on the Nervous System	74	Le Sueur on the Heart	63
Arnold's Practical Anatomy	75	Le Sueur's Practice of Physic	64
Arnold's Medical Dictionary	76	Le Sueur on the Eye	65
Arnold on Women	77	Le Sueur on Diseases of Females	66
Arnold's Chemistry	78	Le Sueur on Diseases of Children	67
Arnold's Practical Chemistry	79	Le Sueur on Diseases of the Eye	68
Arnold's Medical Notes and Reflections	80	Le Sueur on Diseases of the Skin	69
Arnold's Anatomy and Physiology	81	Le Sueur's Principles of Medicine	70
Arnold on Venereal	82	Le Sueur's Human Anatomy	71
Arnold on Venereal Diseases	83	Le Sueur's Anatomy	72
Arnold's Handbook of Medical Science	84	Le Sueur on Diseases of the Skin	73
Arnold and Brown's Physiological Anatomy	85	Le Sueur's Practice on Diseases of the Skin	74
Arnold (J. H.) on Venereal Diseases	86	Le Sueur's Handbook of Obstetrical Medicine	75
Arnold's Physiology	87	Le Sueur on Puerperal	76
Arnold's Chemical Technology	88	Le Sueur on Brain and Mind	77



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